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The Illuminating Engineering Society

The Past Session

ON pages 191-197 readers will find an account of the proceedings at the annual meeting of the Illuminating Engineering Society, held on May 22nd. The past session has been indeed a critical one in the history of the Society. Early in the present year it was deprived, by the sudden death of Mr. Leon Gaster, of its Founder and Hon. Secretary, who had guided its fortunes for nearly 20 years. A well-merited tribute was paid by members of the Society to the manner in which its Council has handled its affairs during the subsequent months. Mr. Gaster stood out as the leading exponent of illuminating engineering in this country. He was not only the founder of the movement in this country, but he was responsible to an exceptional degree for the supervision of its progress. It would hardly have been surprising if, after his death, a period of dislocation had ensued. Actually the work of the Society has proceeded smoothly, and the programme of the session has been completed in a very satisfactory manner. Papers and discussions during the past session have been varied and interesting, and the attendance at meetings has shown that there is a keen spirit amongst members which augurs well for the future.

What, however, is a yet more hopeful sign is that definite progress is now being made towards the solution of various difficulties which have been a source of embarrassment in the past. Chief amongst these is the problem of finance. The work done by the Society in past years was really remarkable considering the very modest financial income it received. Whilst the present income leaves no margin for special expenditure in such directions as conferences, research and educational work, the statement appended to the report of the Council for the past session shows that a decided improvement has already been effected.

Various expedients for improving the position are proposed. It is to be hoped that all sections of the lighting industry, which derives direct benefit from the movement, will support the project of forming a nucleus of "sustaining members." We hope, however, that users of light will also respond to this appeal, for they too are equally concerned in the problem of applying light to the best advantage.

The support attainable from sustaining members is, however, only a part of what is requisite. The great need of the Society is a considerable increase in its membership roll. There is ample evidence of the continual growth of interest in illumination, both at home and abroad, and there is no reason whatever why the membership of the Society should not be very much greater than at present. This increase, we believe, can be readily obtained if each member will share in the work of interesting others, and recognize that the growth and prosperity of the Society depend on his personal efforts. Several of the steps now in contemplation should be helpful in this respect. The idea of holding occasional meetings in the Provinces, with the idea of ultimately forming provincial branches, is a good one. The proposed revision of the constitution, which should ultimately form the basis of Articles of Association, should also help to place the Society on a firmer basis.

Increased membership is an essential step in order to make the Society more powerful and influential, so that the whole question of illumination may rank higher in the public esteem and the principles of good lighting may be more widely appreciated. Whilst we are confident that the Society will in due course be placed on a better financial footing, we also look for a corresponding increase in its activities in coming years, especially in its main field of work, which is educational. There are many ways, besides the discussions at its own meetings, in which an interest in illumination may be fostered. We hope, for instance, that such questions as the initiation of courses in illuminating engineering at leading educational establishments, supplemented by attractive public lectures and discourses to schoolchildren, will be actively taken up. This is a form of work in which quite a number of existing members of the Society might share.

In conclusion, we should like to give expression to the general feeling of admiration of the manner in which Mr. D. R. Wilson has presided over the fortunes of the Society during the past critical session. We welcome the assurance given in his delightful address (page 193) that he will continue to be a good friend to the Society, and we are confident that its welfare will be studied with equal zeal by Mr. C. C. Paterson, who takes up the Presidency next session

Fundamental Factors in Vision

THERE is apt to be a certain confusion of thought in dealing with the lighting of interiors which may best be illustrated by saying that some engineers assume that rooms require to be "lighted up," in the same manner as they need "warming up." In fact, lighting and heating are distinct problems. Almost invariably we aim at uniform warming of a room. In a measure it is true that a certain general level of illumination in workrooms should also be aimed at; but it would be more correct to say that in the case of most industrial processes there are certain spots where the light is most urgently needed, and the degree of illumination required may be so high as to render reliance on uniform lighting impracticable.

This idea found expression in the discussion on the lighting of printing works before the Illuminating Engineering Society some time ago. There was a distinct tendency to suggest a general illumination of the order of 3 foot-candles, with a super-illumination, up to 20 foot-candles, on the actual spots where the light is mainly needed. Attention is drawn in a recent issue of the *Electrical World* to this reversion to earlier practice; but it is pointed out that the whole scale of illumination has been advanced, and that the local lighting now proposed is something different from the local lighting by pendent units, now generally discredited.

The problem has, however, been carried a step further in several recent papers read in the United States, notably in an excellent contribution by Mr. A. A. Brainerd, which was awarded the McGraw prize in the N.E.L.A. Convention, and was mentioned in this journal recently.* Mr. Brainerd emphasized the futility of relying exclusively on very high illuminations, without giving sufficient attention to other factors, such as glare and contrast. This point is dealt with in fuller detail in the recent paper by Dr. Percy Cobb and Mr. F. K. Moss.† Dr. Cobb's contributions to the study of illumination are always suggestive, and it is encouraging to note how closely the physical requirements of the eye, on which the final judgment of an installation depends, are now being studied. He points out that the four fundamental variables determining the visibility of an object are (1) the size of its critical detail, (2) the contrast between the object and its background, (3) the brightness-level to which the object is illuminated and (4) the time during which the image of the object is allowed to rest upon the retina of the eye. Diagrams are presented illustrating the effect of these various factors. The importance of the first three factors is now becoming better understood, but it is not often that sufficient attention is devoted to (4)—obviously a factor which has a material influence on speed of production.

On the whole, assuming that everything possible has been done to eliminate glare, we are disposed to think that the most important factor is *contrast*. Illuminating engineers do not always realize what a valuable implement this is; judicious attention to contrast may do quite as much to make vision easier as increasing illumination. In certain cases it may enable better visibility to be secured with a lower consumption of gas or electrical energy—surely one of the most practical demonstrations of the skill of the illuminating engineer.

* *The Illuminating Engineer*, May, 1928, p. 130.

† "Four Fundamental Factors in Vision," *Transactions*, Illuminating Engineering Society, U.S.A., May, 1928.

Recent Advances in Actinotherapy

ILLUMINATING engineers cannot but be interested in the influence of light, more especially the ultra-violet rays, on health, which has captured the public imagination so completely during recent years. Readers may therefore be referred to a paper read at the first International Conference of Light and Heat by Dr. Albert Eidinow, who is a recognized authority on these problems.* The public mind has been impressed by the reiteration of statements referring to the sun as "the great healer." In this phrase there lies a great fundamental truth, which makes a special appeal to those of us who live in cities in northern latitudes, where, unfortunately, the sun's rays are so often obscured by clouds or smoke. Yet those familiar with tropical regions can bear out the statement that the solar rays may be dangerous as well as curative; that wisdom is necessary even in utilizing the powers of the sun.

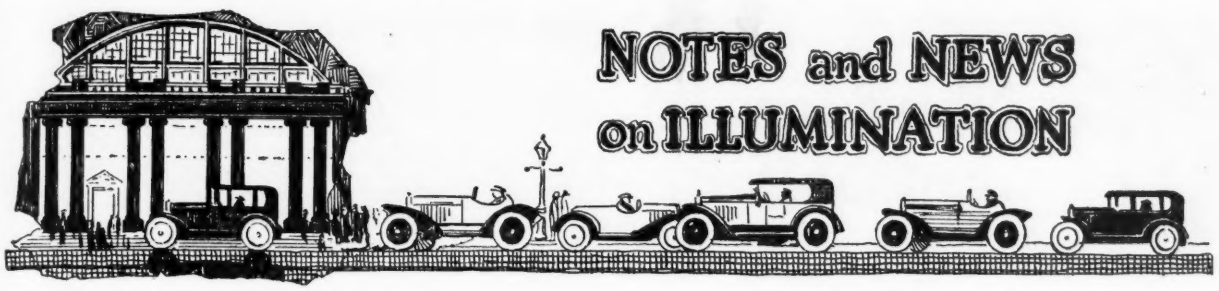
From recognition of the healing power of the sun to the use of "artificial sunlight" is a short step. Yet, as Dr. Eidinow points out, the radiation from many of these artificial illuminants differs widely from that of the sun, and much remains to be learned regarding their effect. The influence of the sun under normal conditions may be described as "long ray therapy," only rays of wavelength between 3,300 and 2,970 A.U. being utilized. Members of the public who desire to use artificial sunlight as a tonic would therefore do well to confine themselves to lamps furnishing radiation broadly similar to that of the sun, i.e., not emitting rays much shorter than 2,970 A.U. In the treatment of special diseases the rays of shorter wavelength may be very valuable, and in many cases are more effective than those of longer wavelengths. But the local reaction may be severe, the danger of overexposure is greater and the technique is more complex. Hence, generally speaking, this form of radiation should only be applied under the guidance of a skilled physician.

Whilst recommending caution in the use of artificial sunlight Dr. Eidinow fully confirmed the remarkable effects attending its skilful application to certain diseases. The valuable influence of ultra-violet rays on rachitic and tubercular patients seems to be well confirmed. Local irradiation may heal many chronic inflammatory lesions. But there is much that is obscure in the action of rays of short wavelength. Overexposure may have ill-effects, causing lowering of blood pressure, restlessness and fatigue—all symptoms associated with "light stroke," which is probably due to the dislodgement of very minute clots into one of the more vital organs.

Dr. Eidinow mentions one fact that may not be generally known, the important influence of exposure to heat and infra-red radiation which seems to accelerate the effect of ultra-violet rays and materially affects the desirable period of exposure. This probably explains why on a warm sunny day it is possible to become sunburned in perhaps ten to fifteen minutes, whilst on a cold day, even with a blue sky, no sunburning may occur even after several hours' exposure.

It is well that Dr. Eidinow's warning should be recorded. Such warnings need not impair our belief in the beneficent powers of sunlight. They merely affirm the wise saying that one may have too much of even a good thing.

* *The British Journal of Actinotheraphy*, March, 1928.



NOTES and NEWS on ILLUMINATION

Second International Exhibition of Light and Heat

We understand that a second International Exhibition of Light and Heat in Medicine, Surgery and Public Health has been arranged to take place at the University of London (Imperial Institute Road, South Kensington) during October 29th to November 1st, 1928. The first exhibition of this kind, held last December, attracted a considerable amount of attention and was well patronized by the medical profession. Most of the papers read and the exhibits on that occasion were concerned primarily with the application of light (artificial sunlight) in medical treatment rather than with the relation of light to health in its broadest aspects. The next exhibition, we gather, is intended to be somewhat wider in scope, and we hope that the value of good illumination in relation to health, safety and efficiency will also be studied.

High Power Illuminants

The introduction of 30-amp. enclosed flame arcs in Leipzig has recently attracted some attention, in view of the fact that the candlepower ascribed to these lamps (8,000 HK.) is probably the highest yet attained in a single lamp used for street lighting. It will be interesting to observe whether similar increases in the candlepower of incandescent lamps become usual. At present, as is well known, lamps of 4 kw. capacity have been manufactured and are in regular use in a number of lighthouses in this country. Such lamps are used in duplicate, an ingenious apparatus permitting the substitution of either one of them should the other fail. We believe, however, that the manufacture of lamps of this capacity, in itself a noteworthy technical achievement, does not represent finality, and that incandescent lamps of considerably higher wattage and candlepower have in fact been made. Whether, for ordinary purposes of illuminating engineering (for example, in street lighting), the production of individual sources of very high candlepower is desirable is a more debatable question. Some people might consider that if higher candlepowers are to be provided it would be preferable to adopt the system of mounting clusters of lamps on the one post, which has been applied with good results in some of the so-called " White Way " systems.

The Transmission of Ultra-Violet Rays

In view of the importance attached by the medical profession to the influence of ultra-violet rays on health, the transmission of these rays by various media is now receiving more study. There are now several distinct varieties of window glasses stated to be permeable to ultra-violet rays on the market, and it may be that the regions transmitted in the various cases are not identical. The question of the amount of light transmitted by various fabrics is also being discussed. It has been stated that artificial silk is exceptionally permeable, but according to a recent investigation this is not an inherent quality, but usually arises through the large interstices in the material. One point that deserves attention is that transparence may vary greatly in different parts of the spectrum. An instructive contribution by Mr. Tsukamoto in a recent issue of the *Revue Optique* shows that as one proceeds towards the shorter wavelengths water is at first more transparent than quartz but ultimately less so, and the same may apply to other materials.

Kinema Theatre Lighting

The kinema theatre now offers an excellent field for ingenuity in designing lighting effects. Seeing that the primary object is to exhibit films in darkness or semi-darkness it may seem strange to describe the kinema theatre in these terms. But as the picture palace, like the theatre, is essentially concerned with an appeal to the eye it is natural that lighting effects should tend to play an ever more important rôle. A good idea of recent progress may be gathered by a study of *The Ideal Kinema* in which descriptions of typical recently equipped theatres appear. The new Madame Tussaud's theatre has interesting features, the auditorium fittings being of novel design. Major C. H. Bell, in an article entitled " Comfort in Equipment," emphasizes the dominant influence of illumination, and elsewhere the range of appliances now available for stage lighting—which approach in variety those furnished for the ordinary theatre though naturally not so extensive—is illustrated. We were specially interested in Mr. J. F. Mead's discussion of " atmospheric decoration," which implies the building-up of scenery adjacent to the screen and serving to supplement the story it conveys—again an illustration of the manner in which the picture palace is absorbing the technique of the theatre proper. Naturally the use of such scenic devices at once places the lighting of the auditorium on a more important footing. The method of illumination then becomes an essential part of the entertainment, and the lighting, if subdued, should be capable of being exploited without in any way interfering with the appearance of the picture on the screen.

Illumination in Relation to Health

It is always gratifying to find how references to illuminating engineering are becoming more frequent in other journals besides our own. As an instance we should like to mention the excellent survey of articles bearing on illumination in relation to health which appear in the *Bulletin of Hygiene*. The April issue contained abstracts of quite a number of recent articles in *The Illuminating Engineer*. Amongst others, Mr. Cooper's investigation of electric lighting in the engineering industry, Mr. Weston's paper, read in 1927, on the effects of illumination on fine work, and some comments on the importance of shadow in industrial lighting are dealt with. We may also mention an excellent article by Mr. A. M. H. Davies on factory lighting, which appeared in the *Journal* of the National Institute of Industrial Psychology, and a recent contribution in *The Medical Officer* on the estimation of daylight illumination in schools. The author describes as " good " installations in which the daylight factor of 2 per cent. was recorded in the middle of the room, whilst installations are considered " bad " when only one-tenth of this value is attained.

Mr. D. R. Wilson, C.B.E.

We are glad to record a pleasing item in the recent Honours List, the conferring of the "C.B.E." on the President of the Illuminating Engineering Society, Mr. D. R. Wilson. We are sure that all readers will join with us in congratulating Mr. Wilson on this well deserved recognition, and that all members of the Illuminating Engineering Society will note with pleasure the honour conferred on their President.

Street Lighting Abroad

A correspondent sends us some notes on his experiences during recent visits to Holland and Germany. He is much impressed by the advances in street lighting. One interesting feature is the extending use of open reflectors with a diffusing-glass ring, similar to those recently described in this journal, whilst in some towns, notably Leipzig, the lighting of large open spaces and squares with 30-amp. enclosed flame arcs is being further developed. In Berlin floodlighting has also been increasing very rapidly. Quite a number of important buildings are being treated in this way, but the usual practice differs somewhat from that in this country, where the projectors in most cases have to be attached to the frontages of buildings. In Berlin this method is rarely adopted. It is much more usual to find the projectors mounted on poles adjacent to the building at heights varying from 9 to 15 feet, or on similar poles on the opposite side of the street. Local regulations in this country would usually be opposed to this system, but in Germany there seems to be no obstacle, and it is not unusual for the authorities to sanction the attachment of floodlighting units to tramway standards. Occasionally posts carrying up to 15 such floodlights may be seen. This method, which enables the projectors to be mounted at a greater distance from the surface illuminated, has manifest advantages, and the results at night-time are sometimes quite remarkable. Our correspondent also comments on the efficient lighting of railways in Germany and Holland, mainly by means of high-powered units mounted at heights of 30 feet or more.

Directional Signs in American Stores

Much effort is now expended on the general lighting of the interiors of stores. The illumination in the chief London stores is on a generous scale, but it has sometimes occurred to one that more attention might be devoted to directional signs, enabling visitors to these huge buildings to find the departments they desired more quickly. The problem of rapidly handling crowds is not unlike that experienced on the underground railways, where signs giving information have proved of great benefit. American stores have recently been studying this subject, not only with a view to getting visitors to their destination quickly but also as a means of influencing those customers who are apt to wander about somewhat aimlessly and whose minds need to be made up for them. In other words signs are being more and more exploited, not only for convenience but as a selling agent. It is stated that one of New York's largest department stores now spends twice as much on directional lighting and facilities as it does on other types of lighting. In the picture palace directional signs also tend to play an increasing rôle. It is said that one of the largest cinema theatres in New York has invested about 40,000 dollars for interior directional lighting alone.

Illuminating Engineering in Japan

The journal of the Japanese Illuminating Engineering Society contains a summary of street-lighting conditions in England and Germany, contributed by Mr. E. Ogawa. The contribution is mainly statistical although, being printed in Japanese, its contents are somewhat difficult to ascertain. Data relating to various provincial cities in this country are assembled in tabular form, and quotations are made from the Public Health Act (1875) and other regulations. The lighting of the Tokyo underground railway, described by Messrs. Y Harada and S. Takama, seems to resemble generally that adopted on the underground railways in London. Certainly the interior of a coach equipped with straphanging devices seems familiar. The illumination on platforms is stated to be of the order of 2.5 to 5 foot-candles, which is relatively high, and the illumination in the cars, measured in a horizontal plane 80 cms. above the floor, approaches 4 foot-candles.

"Rational Lighting"

The claims of "rational lighting" continue to be emphasized by M. Haulx in *l'Eclairage*, the little journal now being published under his direction in Brussels. Most of the articles deal in very simple language with the fundamental principles of good lighting. In the April and May issues there are notes dealing with the effect of illumination on visibility, modern shop lighting, street lighting, etc., as well as descriptions of the chief illuminants. Amongst the more technical articles we notice an account of the applications of chromium for producing good reflecting surfaces. In view of its resistance to oxidation and durable qualities, this material is proving of considerable utility for various types of special reflectors. There are also short notes on progress in various countries. We observe that the military college of Mexico has recently adopted an improved modern system of illumination, the chief lecture theatre being lighted by 200 lamps concealed behind the cornices.

A New Incandescent Lamp

Some interest has been excited in the United States by the introduction of a new type of electric incandescent lamp which seems to meet a distinct want. There is now a wide demand for lamps of relatively small consumption for sign and decorative lighting. It has been found that hitherto the bases of existing lamps were either too large to permit the desired delicacy of design or too small from the standpoint of lamp performance and manufacture. The type now introduced has what is described as an intermediate base, of the Edison screw socket type, which is $\frac{5}{8}$ in. external diameter. The lamp itself, which consumes only 10 watts, is very compact, the bulb is roughly spherical and the diameter is only about $1\frac{1}{2}$ ins. These lamps are available on 110, 115 and 120 volts, the standard pressures in the United States, and can be supplied in a wide range of colours—red, yellow, green, blue, flame-tint, white, etc.

Propaganda on Good Lighting in Germany

Our readers must be familiar with the useful work that is being done by the E.L.M.A. Lighting Service Bureau in this country. It is of interest to turn to a record in *Licht und Lampe* of what has been done by the Osram-Lichthaus in Berlin. The outstanding fact is that during the year 1927 about 125 addresses and papers were delivered, and the institution was visited by over 10,000 persons. Many of these visitors came from abroad. In the month of January in the present year there were 135 visitors from other countries, which included Finland, Norway, Sweden, Holland, Austria, The United States, The Argentine, Brazil, Guatemala and China! What is specially striking is the series of address talks given to schoolchildren. Nearly 100 talks of this kind were given, so that the rising generation in Berlin must be growing up with a distinct bias in favour of good illumination!

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

Proceedings at the Annual Meeting of The Illuminating Engineering Society

(Held at the Home Office Industrial Museum, Horseferry Road, Westminster, S.W.1, at 6 p.m. on Tuesday, May 22nd, 1928.)

THE Annual Meeting of the Illuminating Engineering Society was held at the Home Office Industrial Museum (Horseferry Road, Westminster, S.W.1, at 6 p.m. on Tuesday, May 22nd, the PRESIDENT (Mr. D. R. Wilson) in the chair.

After the minutes of the last meeting had been taken as read, the HON. SECRETARY presented the names of the following applicants for membership:—

Ayengar, T. K. R. ....Mains Engineer, Bombay Electric Supply Co. Ltd., Fort Bombay, India.

Brown, A. G. .....Technical Staff, General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.

Gardner, B. T. .....Messrs. A. W. Beutell Ltd., 96, Victoria Street, London, S.W.1.

Good, P. .....British Engineering Standards Association, 28, Victoria Street, London, S.W.1.

Hewitt, F. H. .....Electrical Tester (G.W.R.), 22, Park Lane, Swindon.

McGee, W. B. .....Messrs. Best & Lloyd Ltd., Edgbaston, Birmingham.

McGibbon, A. R. .....Messrs. A. W. Beutell Ltd., 96, Victoria Street, London, S.W.1.

Marchand, G. I. C. ...Chairman, Restlight Ltd., 40, Norfolk Street, London, W.C.2.

The names of applicants presented at the last meeting of the Society,* were also read again, and these gentlemen were formally declared members of the Society.

Following the conclusion of the above formal business, a delightful address was delivered by the PRESIDENT, in which the wide appeal of the Society was emphasized, and striking illustrations were given of the dominant part played by the human eye in all branches of illuminating engineering. In the words of the President, "Vision is the sense on which all of us almost wholly rely, not only for the duties but for the pleasures of our lives." There is also the music of light, colour, without which we should lose much of life's enjoyment. It is no wonder that illuminating engineering, the study of light in all its applications, is a subject or interest to everyone, whatever his walk in life may be. By the kind permission of the President this address is reproduced on p. 193.

The Report of the Council (see pp. 194-196) was then read in abstract by the Hon. Secretary. Reference was made to the great loss sustained by the Society in the death of its Founder and Hon. Secretary, Mr. Gaster, on January 7th. Fortunately it has been found possible to carry on the work of the Society in the manner he would have desired. The series of papers during the past session has been an exceptionally varied and interesting one, and meetings have been well attended. There have also been other gatherings in which members of the Society have participated, and at which papers have been read dealing with various aspects of illuminating engineering. The illuminating engineering societies abroad likewise appear to be making good progress.

The final portion of the report was devoted mainly to a summary of the measures proposed by the Council to improve the position of the Society. The statement of receipts and disbursements showed that a substantial improvement had been made in the financial position during the present year, but it is evident that additional income is needed to place the Society on a firm foundation and to ensure a margin for special expenditure on conferences, research and educational work. Some help in this direction is expected from the "sustaining members," whose aid the Council is now seeking to enlist. But it is felt that the chief aim of the Society should be to obtain a greatly increased membership, commensurate with the value of the work upon which it is engaged.

In the course of the discussion several suggestions were made. Mr. L. E. BUCKELL emphasized the importance of extending the activities of the Society into the provinces in order to increase its membership. He also raised a question as to the most suitable time for meetings. Mr. SULLY suggested that members should be made better aware of the possibilities of nominating candidates for the Council, if they so desired. Mr. A. W. BEUTTELL emphasized the importance of increasing the membership, and recommended the formation of more committees in order to furnish opportunities for younger members to take more share in the work of the Society.

The PRESIDENT promised that all these points would receive the careful consideration of the Council.

The adoption of the Report was proposed by LT.-COL. K. EDGCUMBE, who congratulated the Council on their successful efforts to put the Society on its feet, and was seconded by Mr. H. BUCKLEY.

A vote of thanks to the President, Officers, and Council was proposed by CAPT. E. STROUD and seconded by Mr. H. BUCKELL, and in conclusion a special vote of thanks to the President for his services to the Society during the past session was moved by CAPT. W. J. LIBERTY, seconded by Mr. C. C. PATERSON, and carried with acclamation.

Reference was made to the acceptance by Mr. C. C. Paterson of the Presidency for the coming season. Members joined with Mr. Wilson, Lt.-Col. K. Edgcumbe and others in expressing their satisfaction in this decision.

A fuller account of the proceedings will be found on pp. 196-198.

* *The Illuminating Engineer*, May, 1928, p. 156.

AN APPEAL TO MEMBERS

The following letter was circulated to members of The Illuminating Engineering Society prior to the Annual Meeting on May 22nd. It is hoped that all members will support the appeal of their President by endeavouring to interest others in the work of the Society and to secure a substantial addition to its numbers.

May, 1928

Dear Sir or Madam,

Your Council has been actively engaged during the past few months in reviewing the position of the Society and considering plans for its future. The death of Mr. Gaster, which we deplored so much, threw a sudden burden upon those responsible, and particularly on our acting Hon. Secretary, Mr. Dow.

Now that the present position is becoming clear, and also the policy it appears desirable to follow in the future, we should like to feel that every member of the Society is "au fait" with the position. The attendance and interest shown at our meetings this year are evidence of the keenness of the members, and we feel that still further support for the Society will result from a virile and democratic policy in the handling of the Society's affairs.

Firstly, we have in course of preparation for submission to the members of the Society an entirely revised constitution, which will, if adopted, cause the government and administration of the Society to be much more like that of other Societies than has been the case under the old constitution. We shall in due course propose to you that the Society be incorporated under these new articles. Hitherto the Society has not been incorporated.

Secondly, you will be glad to learn that the Society is in a sound financial condition so far as its present rather restricted scale of activity goes. We feel, however, that there are ways of increasing its income and consequently its usefulness, by securing the affiliation of "Sustaining Members" from amongst concerns which are interested in the future of good lighting. A number of such bodies is being approached, and we are hoping before long to have substantial additional support for the Society to report to you.

Over and above this we want additional ordinary members, young men who are keen to get on in the technical and scientific aspects of their work, who want to get known to others and whom the present members of the Society want to get to know. The Society, as we picture it, affords an excellent opportunity for such men, and whatever you can do to bring in others, and by your own influence to make the atmosphere of the Society friendly and helpful to them, will be greatly appreciated by all.

I may mention that the Council is giving a special consideration to the question of increasing the membership in the Provinces, and has in view an arrangement whereby such members would rank as "Country Members" and would pay a reduced subscription.

The Annual Meeting of the Society is fixed for May 22nd, 1928, and I hope you will be able to be present. As no new nominations have been received, the names of the existing Officers and Council are presented on this occasion for re-election, with the exception that the Council has nominated Mr. C. C. Paterson as President for the coming session. In view of the exceptional position arising through Mr. Gaster's death, it is felt that the continuity thus secured will be an advantage during the coming year; but it is hoped that the election twelve months hence will be made in accordance with the amended constitution, and will afford an opportunity for new names to be presented.

Yours very truly,
On behalf of the Council,

D. R. WILSON,
President.

PRESIDENTIAL ADDRESS

By D. R. WILSON, C.B.E.

(Member of the Home Office Departmental Committee on Lighting in Factories and Workshops; Member of the Illumination Branch Committee of the Department of Scientific and Industrial Research; Secretary of the Industrial Fatigue Research Board).

(*Delivered at the Annual Meeting of the Illuminating Engineering Society, held at the Home Office Industrial Museum, Horseferry Road, Westminster, at 6 p.m., on Tuesday, May 22nd, 1928.*)

AT the close of my term of office one obvious course open to me would be to review the past year in some detail. You will, however, shortly hear the Annual Report of the Council read by the Hon. Secretary, and I propose, therefore, to limit myself to a very few words on this subject, and then I ask for your indulgence whilst I mention a few points relating to the more general aspect of illuminating engineering.

The absence of Mr. Gaster's energy and personality has, of course, been felt by all of us during the latter part of the session, and this situation must continue for a long time to come. We were very fortunate, however, in having Mr. Dow, with all his past experience of the Society's affairs, with us, and in his consenting to take Mr. Gaster's place. The result has been that with his help the Society's affairs have, as I hope you will agree when you have heard the report, been placed on a satisfactory basis, and there is every indication that it has before it a flourishing and progressive existence.

Now, with your permission, I will devote a few minutes —I was especially enjoined to be brief—to the main subject I have selected for my address. The membership of this Society is heterogeneous, that is to say, it contains, besides experts in the different aspects of illuminating engineering, many who, like myself, are interested rather than learned. I am an amateur, in the French sense of the word, a lover of the subject, and it occurred to me that it might be of some service to my fellow-amateurs if I were to think out what are the real reasons underlying this interest in a subject of which one has no profound knowledge.

Well, let us take first the eye itself. Physiologists may perhaps correct me, but the eye, both structurally and functionally, has always appeared to me to be the organ of the body impressing one most of all with the marvels of the human organism. When we consider its powers of adjustment to changing environmental conditions, its complexity of structure, its continuous activity without fatigue, its close relationship to the brain and mind, there can, I think, be few who will maintain that the reproduction of such an organ in successive generations of man is not in itself proof of the existence of some form of supreme power and intelligence, by whatever name this may be called.

Next, let us turn to vision and remember the enormous part it plays in our daily lives. It remains by far our most important source of impression—although some of my younger friends may remind me that the eye can on certain occasions operate very effectively as an organ of expression—and, indeed, when we have excepted music, interviews, debates, conversations both personal and telephonic, vision is the sense on which all of us almost wholly rely not only for the duties but for the pleasures of our lives.

Take, for example, physical measurements. All the most exact determinations from the vernier to the ultra-microscope depend ultimately on vision. As a distinguished former President of the Society, Sir John Parsons, said in his Presidential Address in 1922:—

> "Physicists too often forget that the basis of physical measurements is biological, for the so-called "outer world" only exists for us by virtue of the sensations it arouses in our bodies. Physical measurements are open to the errors of all human observations, and these vary in degree according to the type of observation. In all cases the observation is the formation of a judgment, based on the sensations derived from the stimulation of a sensory organ. Physiological experiments show that stimulation of some sensory organs gives more sharply defined responses than others. Thus, the responses to smell and taste are crude and vague; those to moderate cutaneous stimuli—touch and temperature—much better defined; those to auditory stimuli still better, and those to visual best of all. The most highly differentiated sensory organ is the eye."

These words remain true to-day. The eye is almost unconsciously accepted as the primary subjective instrument of discrimination, and, in fact, I can think of no exception, save one that was introduced during my young days—the determination of the electrical conductivity by Kohlrausch's method, wherein in order to evade the effects of polarization balance was obtained by means of the telephone.

Lastly, there is the phenomenon of light itself. Light is not like mere sound. It is of cosmic, not mundane, origin. Its vehicle is not air, but the mysterious imponderable matter, known as ether, that pervades the whole universe. It is not wafted aside by every "gentle gale"; it moves unswervingly in straight lines —or, in view of recent knowledge, I ought perhaps to say in lines that under terrestrial conditions may be regarded as appreciably straight.

For this reason, physical optics is an almost exact science; the laws of reflection, refraction and propagation are no mere approximations, and the behaviour of light can be expressed in formulæ, which, though often complex it is true, are precise in the sense that they can be calculated in the certainty that light will conform to them.

But, apart from the physical properties of light, let us remember the extent to which it influences our lives. First, it is, as I have already said, the medium by which we mainly learn, either through reading or through measurements, and I think that it is even true to say that the impression left after an interview with a person depends almost as much on visual judgment as on aural assimilation. Secondly, we depend on it very largely for the avoidance of the dangers to which in these days all of us are exposed to a greater or less extent. It is indeed significant to recall that the safety warnings on railways are ordinarily light-signals, and that sound in the form of fog-signals is only brought in as a *pis aller* when conditions make the use of light impossible. Thirdly, light plays an important part in our hygiene and health; not only in preventing the accumulation of harmful germs, but, as in the case of the ultra-violet rays, in acting positively as a curative and health-stimulating agent. Truly, it is not without significance that the first stage in converting chaos into order was the command "Let there be light."

Finally, there is the music of light, colour. I remember many years ago visiting Whakarewarewa, in New Zealand, the scene of the volcanic eruption that destroyed the famous white and pink terraces in 1886. Before then it had been similar to Scotland, with its wonderful variety of shades and contrasts. On my visit it was the picture of desolation—impressive almost beyond words, but completely deprived of its original charm and beauty. This is but an illustration, but it indicates what we should lose in life's enjoyment were we to be deprived of colour, which is indeed one of the primary constituents of beauty.

These then, gentlemen, are some of the reasons why illuminating engineering, using the term in its widest sense, has made a special appeal to me, and I cannot but believe to some of you present to-day. Speaking from my own experience, I can truly say that no person of average intelligence can fail to derive benefit and enjoyment from even a superficial study of a subject that affects our health, our safety, our daily work and our amenities so closely.

Now, as this is the last occasion on which I shall address you as President, may I say how deeply I have appreciated the honour of having been so elected, and the consideration and help I have received from every quarter.

Busy men have devoted many hours to attendances at Council and Committee meetings, and I have been deeply impressed with the evident determination of members of the Council to make the Society a real and lasting success. But to this end we require the active help of the members, especially the younger ones. The great need of the Society is increased membership. There is evidence that this need is gradually being met, but I would appeal to every member to make a Whitsuntide resolution to obtain at least one new member before the next session. If this could be done, a prosperous future for the Society would be definitely assured.

You will, I know, share my pleasure in realizing that Mr. Paterson has been selected as my successor as President. This pleasure on my part is due, not only to the fact that he is an old personal friend—beginning from the time when we were joint secretaries of a committee, many years ago—but also to the conviction that the direction of the future of the Society could not be placed in more appropriate or more capable hands.

Report of the Council for the Session November, 1927—May, 1928

(Presented at the Annual Meeting of the Illuminating Engineering Society, held in the Lecture Theatre of the Home Office Industrial Museum, Horseferry Road, Westminster, S.W.1, at 6 p.m. on Tuesday, May 22nd, 1928.)

IN presenting their report for the past session the Council's first duty is to record the great loss sustained by the Society in the sudden death of its Founder, Vice-President and Hon. Secretary, which occurred on January 7th. An appropriate resolution was passed at the first meeting of the Society following Mr. Gaster's death, and a biographical notice summarizing his manifold services to illuminating engineering has appeared in the journal. Many messages of sympathy have been received from the illuminating engineering societies abroad and from others expressing their esteem for our late Hon. Secretary.

The general feeling, as expressed by the President in his brief address on January 24th, is that the best service that can be rendered to Mr. Gaster's memory is to ensure the continued progress and prosperity of the Society on whose behalf he laboured so assiduously; and the Council desires to take this opportunity of gratefully acknowledging the aid received from members generally during this difficult period. The continuity of the work of the Society has been greatly facilitated by the fact that Mr. J. S. Dow, who is now acting as Hon. Secretary, has assisted Mr. Gaster from the commencement of the Society nearly twenty years ago, and is thus familiar with the procedure followed in the past.

Meetings of the Society.—The ordinary work of the Society has thus been carried out without interruption, and the record of meetings held during the session compares favourably with that of any previous year. In addition to visits, seven regular meetings, including the Annual Meeting, will have been held. The opening meeting on November 22nd, 1927, was, as usual, devoted to reports of progress and exhibits illustrating recent developments in lighting appliances and apparatus. The customary report on progress during the vacation was presented by Mr. L. Gaster, and reports on progress in electric lighting and gas lighting were presented respectively by Mr. S. H. Callow (Chairman of the Committee on Progress in Electric Lamps and Lighting Appliances) and Mr. H. Talbot (Chairman of the Lighting Section of the Society of British Gas Industries).

The next item on the programme was a paper by Mr. J. L. H. Cooper, entitled " An Investigation of Electric Lighting in the Engineering Industry." This paper contained a large amount of interesting statistical data and led to a useful discussion, which was opened by Mr. E. A. R. Werner (H.M. Superintending Inspector in the Midland Division). At the subsequent meeting on January 24th the plan adopted so successfully in the previous session of holding a general discussion on " Problems in Illuminating Engineering " was again followed. A series of short contributions on various topics was presented by Mr. S. G. Elliott (" The Lighting of Escalators "), Mr. A. Cunnington (" Foundry Lighting "), Mr. H. C. Weston (" The Use of Special Glasses for Very Close Work "), Mr. C. E. Greenslade (" Daylight Illumination "), and Mr. J. S. Dow (" The Lighting of Tunnels and Subways ").

On February 28th members of the Society were the guests of the E.L.M.A. Lighting Service Bureau, when the recently reorganized Demonstration Theatre was publicly shown for the first time, and numerous ingenious devices illustrating the comparative effects of good and bad lighting were on view. A comprehensive address was delivered by Mr. W. E. Bush (Manager of the Bureau), summarizing its recent activities, and was followed by an interesting discussion. Members were entertained by Messrs. Holophane Ltd. at the next meeting, on March 13, when Dr. S. English read a paper entitled " The Manufacture and Properties of Glass and their Application to Illuminating Engineering." This paper, which dealt with a subject on which little has been published hitherto, was illustrated by numerous experiments, and led to an excellent discussion, which was opened by Professor W. E. S. Turner (Secretary of the Society of Glass Technology).

By the permission of the Home Office, the last meeting prior to the Annual General Meeting was held in the lecture theatre of the Home Office Industrial Museum. On this occasion a discussion on " Daylight, Artificial Light and Artificial Daylight " was opened by Mr. J. S. Dow. This paper also led to a good discussion, in which a number of interesting questions, such as the explanation of the difficulty in working by a mixture of natural and artificial light, the best method of supplementing daylight by artificial means, and the comparative influence of natural and artificial light on acuteness of vision were raised.

The attendance at meetings throughout the session was exceptionally good, and there was evidence of keen interest on the part of members, the number of those desiring to take part in discussions being frequently greater than the time available permitted. The practice adopted of holding meetings in different halls, especially in cases where exceptional opportunities for demonstrations existed, was again found to be beneficial in giving variety to gatherings.

In addition to the regular meetings mentioned above a special visit to the recently opened Home Office Industrial Museum was arranged on February 17th, when a short introductory address outlining the chief objects of the Museum was delivered by Mr. H. C. Weston. Members were specially interested in the lighting section of the Museum, where a number of exhibits illustrating fundamental principles in illumination are arranged.

Other Meetings of Interest.—There have been numerous other gatherings, in most of which members of the Society have taken a prominent part, illustrating the continually increasing interest being paid to the subject of illumination. The fourth Annual Conference of the Association of Public Lighting Engineers was held in Brighton during September 12th to 15th. Special attention was devoted to the discussion of the British Standard Specification for Street Lighting, and in the Presidential Address, delivered by Mr. Alexander C. Cramb, the desirability of establishing some form of central supervision over public lighting was pointed out. This point was again emphasized in a paper read by Mr. W. J. Jones at the Public Works, Roads and Transport Congress, held in London in November. A paper dealing with the scientific principles underlying public lighting, read by Mr. J. W. T. Walsh on this occasion, was awarded the second prize in the open competition organized by the Papers Committee of the Congress.

The Exhibition of Public Lighting Appliances, organized in connection with the Conference of the Association of Public Lighting Engineers was an exceptionally comprehensive one; 24 firms took part, and both electric and gas lighting were well represented.

A feature of the exhibition was the display of luminous signs and devices for the guidance of traffic, and it is evident that this is becoming an important new branch of illuminating engineering. The principles underlying the design of such devices were discussed in a paper read by Mr. W. J. Jones before the Association of Public Lighting Engineers, on February 21st, and a resolution advocating the standardization of such direction signs was passed.

Reports and Specifications.—Two important specifications emanating from committees working under the British Engineering Standards Association have appeared. That dealing with Street Lighting (No. 307, 1927) has aroused considerable interest. Whilst it is recognized that this specification may require some modification as a result of practical experience of its working, it represents an important departure, which should help greatly towards the achievement of greater uniformity in public lighting. Specification No. 324, 1928, dealing with Translucent Glassware, likewise affords an indication of progress in standardization in illuminating engineering, and contains many useful provisions. Other specifications are in preparation dealing with photometric integrators and diffusing materials.

The Illumination Research Committee of the Depart ment of Scientific and Industrial Research has also been continuing its researches. A joint report issued by this Committee and the Industrial Fatigue Research Board carries a step further the enquiry into the effect of different systems of lighting on output and accuracy in fine work (typesetting by hand). This report deals with such questions as the relative effects of direct, indirect and semi-indirect lighting, and is of special interest in connection with effects of shadow. Other interesting reports presented by the Committee deal with " The Natural Lighting of Picture Galleries " (Technical Paper No. 6) and " The Penetration of Daylight and Sunlight into Buildings " (Technical Paper No. 7).

In the field of popularizing knowledge of correct principles of illumination valuable work continues to be done by the E.L.M.A. Lighting Service Bureau, which has recently initiated a special advance course on illumination design, which promises to be quite as successful as previous courses. Several members of the Society have been responsible for popular lectures on illumination, and reference may be made to the course on this subject which now forms a regular item in the curricula of the Polytechnic. It is hoped that in due course such series of lectures will be given at other leading educational institutions.

Illuminating Engineering Abroad.—There is evidence of a progressive development in illuminating engineering abroad. The twenty-first Annual Convention of the Illuminating Engineering Society in the United States, held last October, was the occasion of a very representative series of papers. The Illuminating Engineering Society in Japan has this year celebrated its tenth anniversary. Interesting papers were also presented at the Annual Meetings of the German Illuminating Engineering Society, held in Hamburg during September 30th to October 1st, and of the Illuminating Engineering Society of Karlsruhe. A feature of all these gatherings was the tendency to arrange conferences at which a series of papers dealing with the same group of subjects was read. Thus, the Annual Meeting of the German Illuminating Engineering Society in Hamburg was appropriately devoted to discussions on such subjects as the design of lighthouses and beacons, the lighting of docks and harbours, and navigation lights. The gathering of the Illuminating Engineering Society of Karlsruhe was devoted to a special discussion of physiological and psychological aspects of illumination, and was noteworthy for the number of eminent physiologists and psychologists who contributed to the discussion.

A specially important event was the meeting of delegates of the International Commission on Illumination at Bellagio (Italy) during August 31st to September 4th. For the first time all the countries affiliated to the Commission, including the ex-enemy delegates, were represented. Mr. C. C. Paterson, now President-Elect of this Society, was elected President of the Commission. As members are aware, the session of the International Commission on Illumination is being held this autumn in the United States, and the proceedings should be specially important and interesting.

In many other ways interest in lighting has been manifested abroad. As an instance it may be mentioned that during the present years two new journals specifically devoted to this subject have been issued in Paris and Brussels.

Future Progress.—Having thus surveyed the main lines of development in illuminating engineering in this country and elsewhere it is proposed, in conclusion, to present some information on the position of our own Illuminating Engineering Society. The great loss which the Society sustained early this year in the loss of its Founder and Hon. Secretary, Mr. L. Gaster, is universally recognized, but the subsequent period has been utilized by the Council to survey the whole position, and there is every reason to believe that the Society is about to enter on a career of yet greater usefulness and prosperity, as its Founder hoped. The Council has nominated Mr. Dow to succeed Mr. Gaster as Hon. Secretary, and it has also nominated Mr. C. C. Paterson as President for the coming session, and Dr. J. W. T. Walsh as a Vice-President of the Society. No other nominations have been received, and in view of the fact that substantial alterations in the membership of the Council were made last year, and that the subsequent period has barely sufficed for the existing members of Council to become fully familiar with the problems facing it, members will no doubt be prepared to leave the conduct of the Society's affairs in their hands for the coming session.

The Council desires to take this opportunity of expressing its deep appreciation of the great services rendered by Mr. D. R. Wilson during the past somewhat difficult period, and it has accepted his resignation with regret, and chiefly in deference to the feeling—which is shared by Mr. Wilson himself—that in future the Presidency should not be held for two successive years. The Society, however, will continue to have the benefit of Mr. Wilson's services as a member of the Council. The nomination of Mr. Paterson as President is specially appropriate by the fact that he is this year President of the International Commission on Illumination, and will preside over the important forthcoming session to be held in the United States. The successful continuance of the Society's activities would have been hardly possible but for the invaluable services rendered by Mr. J. S. Dow, their Hon. Secretary, to whom the Council owes a special debt of gratitude for the time and care he has devoted to its interests.

The Council has had under their consideration the question of the revision of the constitution of the Society, and a committee is now engaged on preparing a new draft which, it is suggested, may ultimately form the basis of Articles of Association. This is a necessary step preliminary to ultimate incorporation and registration of the Society. Apart from this consideration it is felt that the existing constitution and by-laws, which are substantially the same as those drafted when the Society was formed nearly 20 years ago, now require modification in many respects. Any such changes will, however, be brought before the members of the Society for their consideration in due course.

One of the chief matters that has engaged the attention of the Council has been the improvement of the financial position. This question has been studied by a specially appointed committee, which has already proposed several steps which should materially improve the position. One obvious need is a greatly increased general membership, and it is hoped that members will individually make every effort to interest others in the Society's work and enlist their aid as members. Another new step is the creation of " sustaining members," i.e., firms, bodies or institutions which agree to nominate one of their representatives with the ordinary privileges of membership, but show their interest in its work by making an annual contribution of not less than £5 5s. Through the efforts of members of the Council several such sustaining members have already been secured, and it is hoped that ultimately

a substantially increased revenue will be secured in this way. Several other proposals are also receiving the attention of the Council. It is hoped during the next session to hold several special meetings in provincial cities, with a view to arousing interest in illuminating engineering and securing additional members. It has for some time been evident that if the Society is to become a truly representative and powerful body branches should ultimately be established in the provinces, and even—looking further ahead—in the Dominions and Colonies.

The special committee has gone very fully into the relation of the Society to its official organ, and the Council recognizes that the present arrangement is a very beneficial one to the Society and recommends its continuation for the present. It is felt, however, that in view of the extending activities of the Society it would be desirable ultimately for the Hon. Secretary to have the assistance of a secretary, who should be a paid official; and this is one reason why a substantial increase in revenue is desired.

In due course an audited balance sheet for the present year will be presented. For the moment a statement prepared by the Hon. Secretary and Hon. Treasurer is appended, showing the position from January 1st to May 10th, 1928.

As indicated above, the income of the Society still falls far short of what is necessary and desirable to place it on a secure financial footing. This statement is encouraging in showing that a substantial improvement is being made during the present year, but it will be noted that the Society is at present not asked to meet various customary expenses, such as rent of offices, secretarial salary, etc., which may have to be met in the future, and that the present income leaves no margin for special expenditure on conferences, research, and educational work.

In 1929 the Society will attain its twentieth anniversary, and it is felt that this occasion should be marked by some special celebration, and at the same time should be made the opportunity of a widespread effort to arouse interest in the work of the Society, which is of such great benefit alike to the industry and the public. The Council has under consideration the raising of a special fund in memory of the late Mr. Gaster during this anniversary year. This fund would not be used for the ordinary expenditure of the Society but would be invested and applied for some special object, such as the establishment of an annual lecture or the encouragement of research.

D. R. WILSON, *President*
J. S. DOW, *Hon. Secretary*

APPENDIX I.

Statement of Receipts and Disbursements during the period January 1st, 1928 to May 10th, 1928

DR.

RECEIPTS

	£	s.	d.
Balance in hand on January 1st, 1928	21	13	7
Subscriptions (1927 and previous years)	65	2	0
Subscriptions (1928)	320	5	0
Subscriptions (1929)	4	14	6
Life Member	10	10	0
Sustaining Members	64	3	0
Donation (per Mr. J. Y. Fletcher)	21	0	0
	507	8	1

CR.

DISBURSEMENTS

	£	s.	d.
Amounts outstanding on December 31st, 1927 ...	85	16	4
Mr. L. Gaster (Expenses)	20	0	0
Current Expenditure[1] during January, February and March	67	17	0
To Illuminating Engineering Publishing Co., Ltd. :—			
In settlement of amount outstanding on December 31st, 1927	19	19	0
On account for 1928	74	11	0
Cheque Book		5	0
Cash at Bank (May 10th)	238	19	9
	507	8	1

Further Proceedings

After the Annual Report had been presented the Chairman explained that in due course a resolution approving its adoption by the meeting would be moved, but meantime they would be glad to hear any comments on the report or suggestions as to how the position of the Society could be still further improved.

Mr. L. E. BUCKELL referred to the proposed extension of the activities of the Society so as to embrace the Provinces. He regarded this as a most important suggestion. It appeared to him that the possible increase in membership was limited unless considerable additions from the Provinces could be gained. Ultimately, if the Society decided to form local branches, the members of such branches could hold their own meetings, whilst still remaining members of the parent Society, and in these circumstances a relatively large increase in membership might be anticipated. At present people in the Provinces did not know much about the Society. In order to meet this difficulty it might be possible to arrange for several meetings during the coming session to be held in provincial centres. If only ten, twenty or thirty members could attend from London this would furnish a nucleus and local people might be invited. He believed that some plan as this would be very helpful in widening the membership of the Society.

Mr. C. W. SULLY remarked that on this occasion there were no recommended additions to the Council. Whilst the existing members of the Council were, he believed, doing most useful work, he thought that at annual meetings this matter should be considered, and he believed that the existing constitution made provision for such nominations. He thought that possibly members might not be aware of the procedure in making nominations, and he suggested that in future an intimation should be given to members—if not by circular, through the medium of the journal—of the date by which such nominations should be received. He felt that it would help to keep the Society alive and up to date if members were reminded of their opportunities in this respect and given every freedom to take advantage of them if they so desired.

Mr. A. W. BEUTTELL agreed with Mr. Buckell that the most important step at the moment was to increase the membership. In particular it was desirable to attract the young men and to find opportunities for them to share in the work of the Society; for example, on sub-committees which would attend to its various interests. He felt sure that this was the way to encourage the rank and file, and that the younger men would be more likely to join if they felt that they had opportunities of doing something useful for the Society. No doubt when the membership had increased and the Society had more funds available it could consider the question of adding to its activities and the formation of committees concerned with them.

The PRESIDENT thanked members for their suggestions, which he said would receive the careful consideration of the Council. (Some further reference to these matters was also made by the Hon. Secretary at a later stage in the proceedings.)

LT.-COL. K. EDGCUMBE then moved the adoption of the Report. He had watched with the very greatest interest the way in which the Council had carried on under the difficult circumstances by which they found themselves faced early in the year. He was sure that all the members would agree that the Council had put the Society on its feet in a really wonderful way. (Applause.) The Report was a monument to the ability of the

[1] The *Current Expenditure* during the months of January, February and March was distributed as follows :—

	£	s.	d.
Duplications of minutes of meetings, circulars, etc. ...	5	17	0
Postage	8	4	6
Printings of cards for meetings, stationery, advance pulls of papers read at meetings, etc.	14	13	6
Hire of halls for meetings	3	3	0
Fees for reporter and lantern operator	8	5	0
Provision of refreshments at three meetings	9	14	0
Allocation to Hon. Secretary for clerical expenses ...	18	0	0
	67	17	0

[2] The estimated amount due to the Illuminating Engineering Publishing Co., Ltd. in respect of subscriptions received during 1928 is £125 14s.

Council, and he had the greatest pleasure in moving its re-election. It was also a great pleasure to him to propose the election of Mr. C. C. Paterson as President for the coming year. He had known Mr. Paterson for a great many years; but, apart from their personal knowledge, he felt sure that the members of the Society would feel honoured in having as their President the President of the International Commission on Illumination. (Cheers.)

He accordingly proposed: " That the Annual Report of the Council for the past session be adopted; that Mr. C. C. Paterson be elected President of the Society for the coming session; that Dr. J. W. T. Walsh be elected a Vice-President; that Mr. J. S. Dow be elected Hon. Secretary in place of the late Mr. Leon Gaster; and that the remaining Officers and Members of the Council be re-elected for the coming session."

This resolution was seconded by Mr. H. BUCKLEY, and, on being put to the meeting, was declared carried unanimously.

Mr. E. STROUD then proposed: " That this meeting desires to extend a cordial vote of thanks to the President, Officers and Council of the Society for their efforts on behalf of the Society during the past session."

Mr. L. E. BUCKELL, in seconding, said that he felt sure he was expressing the feeling of all members of the Society in saying that he had a greater appreciation than ever before of the work of the Council. They all realized that the Council had met and overcome great difficulties. It was certainly a great thing for the latter part of the session to have been carried through without interruption, notwithstanding the dislocation from the cause which they all so deeply regretted.

This resolution having been carried, the PRESIDENT stated that the formal business was now concluded, but he believed that there were one or two points on which Mr. Dow wished to say something.

The HON. SECRETARY said that he wished to refer briefly to one or two suggestions that had been made during the meeting. He could assure Mr. Buckell that the idea of holding meetings in the Provinces would be carefully considered by the Council. The suggestion had already been made that Mr. Cooper's recent paper summarizing an investigation of electric lighting in the engineering industry should be read at several provincial centres. He quite agreed that such meetings might attract new members who would ultimately form the nucleus of provincial branches. It was, however, necessary to remember that this addition to the activities of the Society would mean more work and that additional help might be necessary in order to deal with this effectually.

Mr. Dow also endorsed Mr. Beuttell's remark on the importance of increased membership, especially amongst the younger men. The Council would have to consider what could be done to interest them. He might mention that Mr. Beuttell himself had brought two new prospective members to the meeting; if everyone would help in the same way they would soon be able to record substantial additions to their ranks.

In regard to the suggestion made by Mr. Sully, he explained that the existing constitution, which was drafted many years ago, was not sufficiently explicit on certain points of procedure. As mentioned in the report, he and several other members of the Council were engaged in drafting an amended constitution, which, after being submitted to the Council, would be presented to members for their approval in due course, and would, it was hoped, ultimately form the basis of Articles of Association. He might mention that Captain Liberty, Mr. Eck and himself, who were doing the initial " spade-work " on this matter, had been struck by the point to which Mr. Sully referred, and had made a revision which they thought would prove satisfactory.

In conclusion, Mr. Dow said he had been asked to convey a special request to the President—that the admirable address which he had delivered should appear in the Journal. (Applause.) He felt sure that the President would willingly accede to this desire.

Mr. L. E. BUCKELL said that there was just one other point he would like to raise—the time at which general meetings were held. He knew that it was not easy to find a time agreeable to everyone, but he believed that many members found it extremely difficult to attend early meetings, for example at 6-30 p.m. He thought that 7 p.m. was a more convenient time, and suggested that the general feeling of members of the Society on this point should be ascertained.

The HON. SECRETARY said that this point had been discussed in the past. 6-30 p.m. was adopted chiefly under the impression that it was preferable to many members to be able to go straight to meetings without an unoccupied interval after leaving their work. 7 p.m. and 7-30 p.m. had been criticized on the ground that dinner then became impracticable. 8 p.m., which had been originally tried, enabled people to dine before coming to meetings, but was inconvenient to those who lived at a distance and did not like catching a late train home.

Another member pointed out that if meetings commenced late there was little time available for discussion.

The HON. SECRETARY suggested that a notice might be inserted in the Journal inviting opinions.

Mr. L. E. BUCKELL asked whether a vote by postcard was not practicable, and the PRESIDENT thought that this was probably the best method of ascertaining the views of members. It was accordingly agreed that a vote by postcard should be taken before fixing the dates of meetings during the coming session.

The PRESIDENT, in winding up the proceedings, said that he looked forward to the future of the Society with the greatest optimism. He felt, as he had felt for some time, that there was a spirit of progress. Meetings had been well attended, and it was noteworthy that many extremely busy men were willing to give up a large part of their time in order to attend. He thought that this should be regarded by any Society as a very promising sign.

CAPT. W. J. LIBERTY asked leave to propose a special vote of thanks to Mr. Wilson for presiding at the meeting and for all that he had done for the Society during his tenure of office at President.

Mr. C. C. PATERSON, in seconding, said that Mr. Wilson had assisted in bringing about a remarkable resuscitation of interest in the Society. The Council and, he thought, members of the Society generally had been greatly inspired by the example of Mr. Wilson, and by all that he had done. He (Mr. Paterson) could not help feeling that Mr. Wilson would be a very difficult President to succeed. He was deeply sensible of the kind references that had been made to himself, but he was thinking at the moment more of what Mr. Wilson had been to the Society and of what he had promised to be to it in the future. It was an encouragement to know that Mr. Wilson would be with them on the Council during the coming session, and he was sure he would continue to be a mainstay to the Society, and would help to carry it forward into a prosperous future.

The vote of thanks having been carried with acclamation, the PRESIDENT briefly expressed his appreciation of this mark of confidence. What little he had been able to do for the Society had been a genuine labour of love, because he was himself intensely interested in illuminating engineering. He could assure members that he would do his very best for the Society in the future and would forward its interests in any way possible.

Illuminating Engineering Society in Germany

SIXTEENTH ANNUAL MEETING.

We note that the sixteenth annual meeting of the Illuminating Engineering Society in Germany was held in Karlsruhe during June 22nd and 23rd, when a series of papers dealing respectively with light as a means of publicity and instruction in illuminating engineering by the aid of practical demonstrations was presented.

In the first section papers by Dr. H. Lux, Dr. Behrens and Dr. Jakob dealt with various aspects of illuminated signs. A special feature in the second section was the description of the new demonstration room of the Lichttechnische Institute in Karlsruhe, contributed by Prof. Dr. J. Teichmüller.

The Variation of Natural Light during the Total Eclipse of the Sun on June 29th, 1927

By the Staff of the Photometry Department of the National Physical Laboratory

ON the occasion of various total eclipses of the sun previous to that occurring in England in 1927, measurements have been made of the variation of illumination. The first reliable measurements are those made by Abney and Thorpe in 1886. A summary of the results of these and other previous investigators is given in a later section of this report. In 1925 a total eclipse of the sun occurred in the United States of America, the band of totality including a great part of the city of New York. On that occasion the Illuminating Engineering Society of New York organized a number of expeditions to observe the illumination of a horizontal surface and a surface normal to the direction of the sun for the whole duration of the eclipse and for some time before and afterwards. The majority of these expeditions experienced good weather conditions. These measurements were published by the Society shortly afterwards.*

The object of the present paper is to describe the work of observers from the National Physical Laboratory who, under the auspices of the Illumination Research Committee, measured the illumination during the total eclipse of the 29th June, 1927. A number of private investigators also made measurements at different places within the band of totality and subsequently published their results in various technical journals In order to make the information in the present paper as complete as possible, these published results have been included.

The Astronomical Data and Choice of Position.—The eclipse of June 29th, 1927, although total, was not a very good one from the point of view of scientific observation. Fig. 1 shows a map of the British Isles with the

FIG. 1.

band of totality marked on it. The altitude of the sun at the centre of totality naturally increased as the point of observation was chosen more and more eastward. It was approximately 11° at Colwyn Bay and 13° at Middlesbrough. It was therefore desirable to choose a spot with an unobstructed view to the east, and as far eastward in the band of totality as practicable.

It might be thought that a position on the centre line of the totality band would have been the most favourable, but this is not necessarily the case. The reason will be clear from Fig. 2, which is a photograph of a

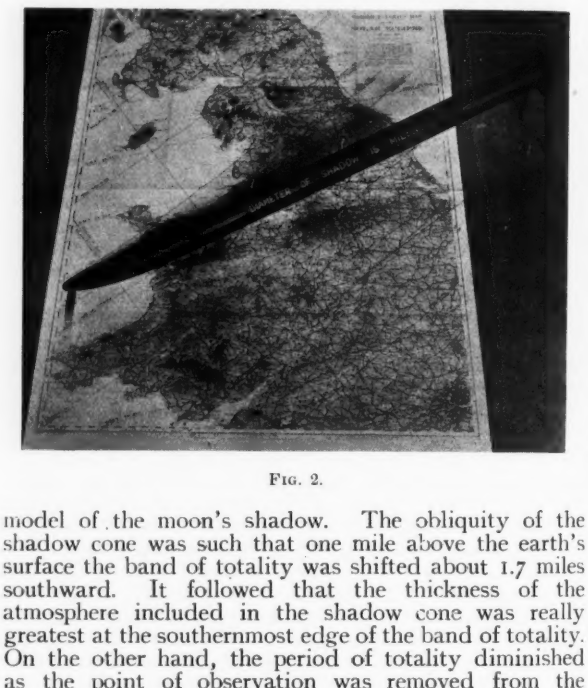


FIG. 2.

model of the moon's shadow. The obliquity of the shadow cone was such that one mile above the earth's surface the band of totality was shifted about 1.7 miles southward. It followed that the thickness of the atmosphere included in the shadow cone was really greatest at the southernmost edge of the band of totality. On the other hand, the period of totality diminished as the point of observation was removed from the centre line, but the difference was very slight for a distance of about eight miles from the centre line. It was therefore decided to select a point a little to the south of the centre line and as far eastward as possible having regard to aspect, freedom from early-morning mists, accessibility, etc. The place finally selected was Leyburn, which is shown by a large circle marked on the map in Fig. 1. The exact position of the field occupied during the observations is latitude 54° 19′ north, and longitude 1° 50′ west of Greenwich. At this spot the sun at totality was about 12.5° above the horizon and the duration of totality was about 24 seconds.

The times of contact were as follows:—

	G.M.T. Hours.	Mins.	Secs.
1st contact	4	30	37
2nd contact	5	24	40
3rd contact	5	25	4
4th contact	6	22	28

Sunrise was at 3-49 a.m.

The object of the expedition was twofold, viz.:—

(1) To determine the variation of the illumination of a horizontal surface due to the light received from a complete hemisphere of sky; and

(2) To determine the variation of the illumination on a surface normal to the direction of the sun due to the sun and corona alone.

The expedition consisted of four experienced photometric observers from the staff of the Photometry Division of the National Physical Laboratory. Two of these reached Leyburn several days before the eclipse, taking with them the bulk of the apparatus to be used. They made a final choice of the site to be occupied. They were followed by the remaining members of the party, who arrived at Leyburn in time for a complete rehearsal of the observational work carried out on

* Illuminating Engineering Society of New York, *Trans.*, Vol. XX, 1925, p. 565.

the site between 4-30 and 6-30 a.m. on the day before the eclipse. This was considered to be necessary, so that every member of the party might feel thoroughly familiar with his part of the work, and so that convenient relative positions could be chosen for those taking the readings and those noting them down. It was the more desirable that everything should work with the utmost possible smoothness on the actual day, since in order to get satisfactory results it was necessary to take readings as frequently as possible, especially during the few minutes immediately before and after totality.

Apparatus for Measuring Horizontal Illumination—The measurements of the horizontal illumination due to a complete hemisphere of sky were made by means of an internally whitened sphere, four inches in diameter, having a circular opening of one inch diameter. When the apparatus was in use the sphere was carefully adjusted, so that the edge of the aperture lay exactly in a horizontal plane. The light from the sun (and corona) was prevented from reaching the aperture by shading it with a disc about 10 feet distant and of such a diameter as, at this distance, to cut off the light from the sun and corona. The actual diameter of the patch of sky shaded by the disc was about 3°. The luminous flux entering the aperture under these conditions was proportional to the horizontal illumination due to the sky alone. This flux was measured by means of a portable photometer of the Macbeth pattern sighted through a small hole in the sphere on to a portion of the inside wall opposite. The arrangement of the sphere and photometer is shown in Figs. 3 and 4. It will be noticed

FIG. 3.

that the observer's head is completely below the level of the aperture in the sphere, and so does not obstruct any of the light. The angular elevation of the objects forming the horizon at the point chosen for the work was nowhere greater than 5°, and averaged about 2°.

It will be seen that, by the ordinary theory of the whitened sphere† the brightness of the internal surface is less than that of a matt card of the same reflection factor, ρ, placed over the aperture. In fact the ratio of the two is approximately equal to

$$\frac{\text{Area of sphere aperture}}{\text{Area of sphere surface}} \times \frac{\rho}{1-\rho}$$

It is easy to determine this factor experimentally, and for the sphere used it was found to have the value 0.33, so that the photometer readings had to be trebled in order to obtain the true values of horizontal illumination.

FIG. 4.

Apparatus for Measuring Normal Illumination.—The illumination due to the sun and corona alone could not conveniently be measured directly, but had to be obtained by difference from separate and alternate measures of the illumination of a surface (*a*) with and (*b*) without the light from the sun and corona. This surface was an ordinary illuminometer test card placed normal to the sun's rays, and about eight inches from it there could be placed a disc of such a diameter that the test point was completely shielded from the direct light of the sun and corona. This disc subtended an angle of about 6° at the test point.

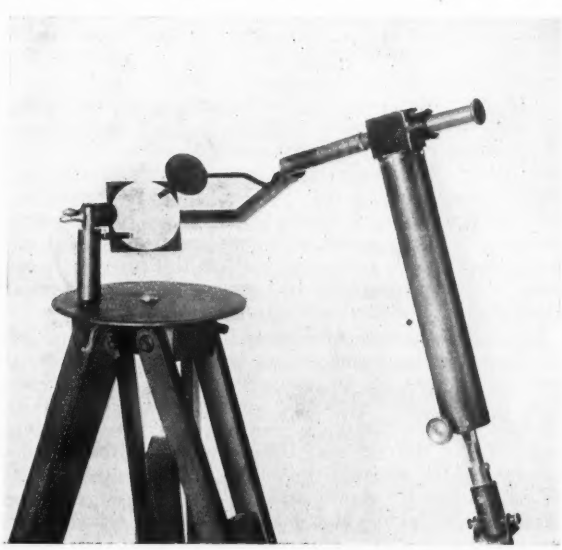


FIG. 5.

† "The Measurement of Mean Spherical Candle-Power." Technical Paper No. 5, 1927, p. 37.

The apparatus is shown in Figs. 5 and 6. Measurements were made alternately with the screen in place and with it removed, so that by interpolation and subtraction it was possible to obtain the illumination due to the sun and corona alone.

FIG. 6.

It might perhaps be asked why it was considered necessary to use a sphere as test surface in the case of one measurement, while in the other an ordinary test card was employed. The chief objection to a test card for the measurement of very diffused illumination is the departure from the cosine law which all surfaces exhibit when light reaches them very obliquely. Even the best matt celluloid or depolished opal glass shows very marked specularity when the light is incident at angles greater than about 70° with the normal, so that in the case of an open-sky measurement, for example, the portions of the sky below 20° from the horizon would not receive their full weight in a measurement made with a horizontal white test surface in the ordinary manner. As, with a sky of uniform brightness, these parts of the sky produce about 12 per cent. of the total illumination, and, in the case under consideration, the sky might be expected to be much brighter near the eastern horizon than elsewhere, it is clear that the sphere possesses marked advantages over the test card for the first measurement.

In the case of the sunlight measurement, however, the same considerations do not apply. The card was placed normal to the direct rays from the sun, and therefore it received, in addition to the sunlight, light from a considerable part of the sky vault and light reflected from the ground and any surrounding objects. It will be seen, however, that all the light it received except that directly from the sun, remained the same throughout the measurements, so that by subtraction the true value of the normal illumination from the sun and corona could be obtained irrespective of the reflection characteristics of the particular test surface used. The same consideration applies to the effect of the observer's head, which in this case was above the level of the test surface.

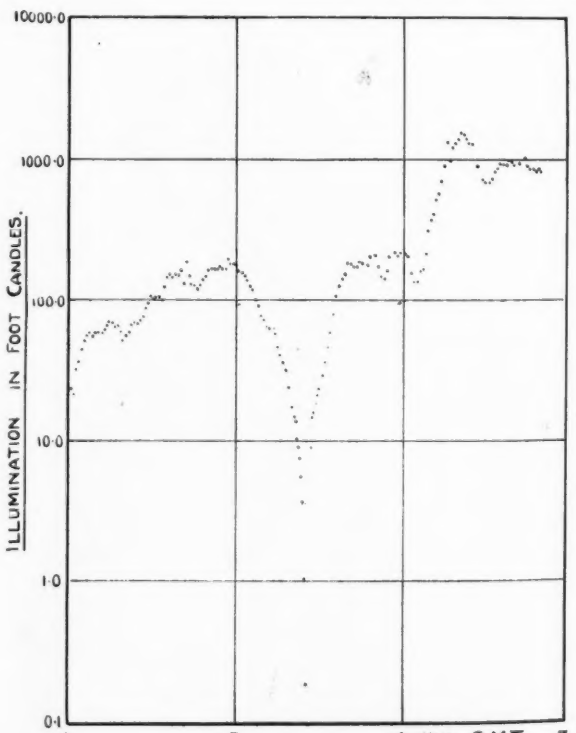
The Photometers.—The instruments used for making the measurements were two Macbeth illuminometers, which were carefully calibrated before and after the expedition. The observers were thoroughly familiar with these instruments, and the estimated accuracy of individual readings is about 5 per cent. The comparison lamps in the instruments were supplied from lead storage batteries of ample capacity, so that the current through each lamp required no adjustment for long periods, although the ammeter was adjusted when necessary.

The ordinary type of neutral light filter was used for bringing the brightnesses to be measured within the normal range of the instruments. These filters were of good neutral glass optically worked on both sides, and the transmission factors were determined in the laboratory. Light filters were also used to obtain colour matches in the photometer fields. These were Wratten gelatine filters (" photometric yellow " type), and their transmission factors for light from a black body at various temperatures was calculated from the spectral transmission curves and the international visibility data. The particular value of colour temperature assumed in the case of the daylight measurements was 5,000° K. The calculated values agreed satisfactorily with the value obtained by direct comparison after the eclipse. As an indication of the variation of transmission with change of colour temperature of the light passing through the filter it may be mentioned that the transmission factor of a particular filter was found to be 53 per cent. and 50 per cent. for black-body radiation corresponding to temperatures of 4,000° and 6,000° K. respectively.

Owing to the shortness of the time of totality it was important that the time at which each reading was taken should be recorded as exactly as possible. This was achieved by having a chronometer which was set just before the eclipse by comparison with the chronometer of a neighbouring expedition which received the broadcast wireless signal at 4 hours G.M.T. It was thus ensured that the times were noted as accurately as possible in the case of a photometric measurement.

Weather Conditions.—The expedition was unfortunate in the weather it experienced, as heavily overcast skies were a predominating feature until well after the totality period had passed. The sun was visible after sunrise as a dull red disc, but shortly afterwards disappeared in clouds; conditions improved a little about 5 hrs. 40 mins., and the partial phase was seen for a few minutes. Occasionally the clouds thinned a little, and suggested that the sun would again become visible; but shortly after 6 hrs. 0 mins. heavy clouds settled over the sun, which was not visible until about 7 hrs. 15 mins.

Results.—Observations were made in spite of the adverse weather conditions, and, as far as the general diffuse illumination from the sky is concerned, Fig. 7 is of considerable interest. There is, of course, the

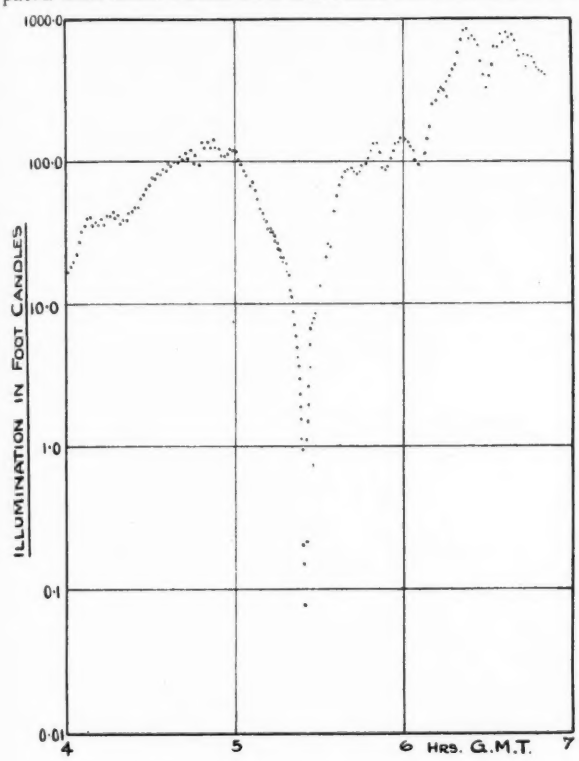


VARIATION OF HORIZONTAL ILLUMINATION DUE TO COMPLETE SKY DURING THE ECLIPSE.

FIG. 7.

combination of two effects: (*a*) the normal increase of illumination due to the rise of the sun in the sky, and (*b*) the temporary reduction of illumination due to the covering of the sun's disc. The minimum value of the horizontal illumination due to the complete sky observed at Leyburn in 1927 was 0.18 foot-candle. The minima reported by the American observers in 1925 varied between 0.13 and 0.40 with an assessed value of 0.24 foot-candle, which refers to good weather conditions.

It is most unfortunate that the weather conditions made it impossible to determine the normal illumination due to the corona, as this quantity would have been of considerable scientific interest. In the hope that the clouds would clear away, or at least thin sufficiently to give some indication of the figure sought, the full programme of measurements was carried out. The values of normal illumination due to the sun and corona, together with the illumination due to the sky and reflection from the ground, are shown by the points in Fig. 8. There was no appreciable difference between measurements taken with and without the disc in position. It was anticipated that there would be a difference between these two



VARIATION OF NORMAL ILLUMINATION DURING THE ECLIPSE.

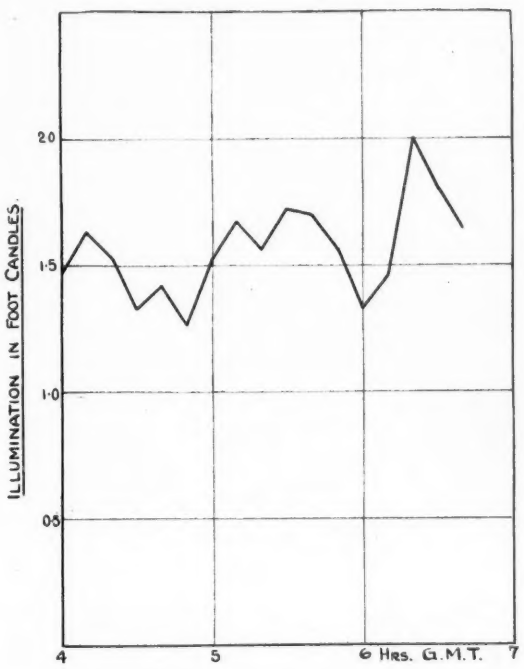
FIG. 8.

which could be attributed to the sun (and corona), and which at totality would give the normal illumination due to the corona alone. As it is, there appears to be no difference between the two measurements except between 4 hrs. 30 mins. and 4 hrs. 50 mins., when the clouds in front of the sun thinned sufficiently to give the sky a higher brightness in that direction than in any other. The two measurements are not differentiated in the curve. The lowest value of the illumination observed was 0.08 foot-candle. The American value for the normal illumination due to the corona was assessed at 0.012 foot-candle, but, of course, this value cannot be compared with the value 0.08 owing to the difference in weather conditions.

Observations were made every minute from 4 hrs. 0 mins. until 5 hrs. 10 mins., then every half-minute until 5 hrs. 20 mins., every quarter-minute until 5 hrs. 27 mins., every half-minute until 5 hrs. 45 mins., and finally every minute until 6 hrs. 50 mins. The measurements of normal illumination were taken alternately with and without the interposition of the disc producing the shadow except near totality, when they were taken without the disc in position.

The programme was carried through without mishap, except that a few observations of the horizontal illumination were missed immediately after totality, due to a misunderstanding in changing neutral filters.

The ratio between the two sets of observations is shown in Fig. 9. This ratio should be constant, except for variations in atmospheric conditions (cloud distribution, etc.), and a slight change in the tilt of the screen used for normal illumination measurements, due to its being continuously adjusted to be normal to the direction of the sun. The average value of this ratio was about 1.5 while measurements were taken.



RATIO. NORMAL ILLUMINATION: HORIZONTAL ILLUMINATION DURING THE ECLIPSE.

FIG. 9.

Results of Other Investigators.—Mr. A. S. E. Ackermann*, at Southport, measured the horizontal illumination on a white card shaded from the direct light of the sun. The weather conditions were moderately satisfactory, the sun being visible the whole time, though covered with a variable amount of cloudy haze. Unfortunately, Mr. Ackermann took no observations between 5 hrs. 22 mins. and 5 hrs. 26 mins., so that his results give no information respecting the corona. They show, however, that immediately before totality the horizontal illumination varied from 300 foot-candles to practically zero in 24 minutes, i.e., 12.5 foot-candles per minute, and that immediately after totality it increased to 500 foot-candles in 23 minutes, i.e., 22 foot-candles per minute.

Mr. J. S. Dow†, observing at Bentham (Yorks.), carried out a continuous series of observations on a horizontal white card, and observed a minimum illumination of 0.5 foot-candle. The sun was visible until a few minutes before totality, and again a few minutes afterwards. At the critical moment the sun and corona were completely obscured by clouds.

Mr. J. E. Guthrie Oliver‡, who observed at Southport, recorded a minimum illumination at totality as 0.02 foot-candle. The corona was distinctly visible, though viewed through a slight haze. Mr. Oliver appears to have been the most favourably treated of all the British observers from the weather point of view. His value of 0.02 foot-candle compares very favourably with the values obtained by previous successful observers, if it be assumed that the foot-candle meter were placed normal to the direction of the sun. If it were placed horizontally, as was most probable, his value for the normal illumination becomes $0.02/\sin 12^\circ = 0.10$ foot-candle.

Mr. J. H. Shaxby§, observing at Criccieth, gives the value of the normal illumination at totality as 0.05 foot-candle. Heavy rain characterized all phases of the eclipse.

* *Nature*, Vol. 120, p. 83, 1927, July 16th.
† *The Illuminating Engineer*, Vol. XX, p. 227.
‡ *The Illuminating Engineer*, Vol. XX, 1927, p. 252.
§ *Nature*, Vol. 120, 1927, p. 84.

Comparison of Results Obtained by Previous Investigators.—Dr. C. H. Sharp, in an appendix to the report of the expeditions organized by the Illuminating Engineering Society of New York, previously quoted, gives a summary of the measurements made during total eclipses prior to 1925. The results are given in the table below:—

Eclipse.	Observer.	Method.	Normal Illumination by Corona (Foot-candles).
1886	Douglas	Visual	0.0157
1889	Leuschner	Visual	0.0093
1893	Forbes	Visual	0.0208
1893	Turner	Photographic	0.009
1905	Fabry	Visual	0.0121
1918	Kunz & Stebbins	Photoelectric	0.055
1922	Briggs	Photoelectric	{0.026 {0.018
1925	Kunz & Stebbins	Photoelectric	0.027
	Sharp	Photoelectric	0.017
	Mean I.E.S.	Visual	0.012

None of the above results are corrected for atmospheric absorption, though a number of investigators using the photoelectric method did make estimates of its effect.

On the whole, there is a fairly satisfactory agreement between the results, though the photoelectric method seems to give higher values than the visual method.

It is not to be expected, however, that the results should always be the same, as the atmospheric absorption may be quite different for the various eclipses. Another cause of variation from one eclipse to another may be the variations in relative sizes of the moon's disc at different eclipses, so that at an eclipse where totality is fairly long, i.e., the moon's disc at its maximum size, the brightest portions of the corona surrounding the edge of the sun are obscured. It is further to be anticipated that the corona may undergo changes in brightness connected with the variation of sun-spot activity.

Determinations of the variation in illumination during partial eclipses of the sun have been made by *Dow and Mackinney, Buckley and Taylor, Eastman, Miss Jones and Hawkins.

Conclusion.—Regarded as a problem of illumination, there now exists a fairly representative amount of data on the variation of illumination during eclipses. Though the data do not make any great claims as regards their accuracy, they do, however, indicate what changes in illumination can be expected during eclipses of varying phases and under varying atmospheric conditions. They should, therefore, serve to answer possible queries as to the effect of eclipses on traffic control by light signals—viz., railway signals, ships' and other navigation lights, particularly in ports and harbours.

From the purely scientific point of view, the problem is only begun. Many problems in connection with the sun can only be studied during eclipses, and not the least important of these are those connected with the energy emission of the corona. For this purpose physical methods of photometry are particularly appropriate. The photoelectric cell has been used on several eclipse expeditions lately, and it is probable that it will be used in all eclipse expeditions in the future, in addition to the usual photographic methods used by the professional astronomer or astrophysicist. At the same time, visual observations have not yet attained all the accuracy of which they are capable, so that we can still look to further advances in our knowledge by this method.

*Dow and Mackinney, Pro. Opt. Conv., 1912.
Buckley and Taylor, *Ill. Eng.*, Vol. XVIII, 1925, p. 295.
Eastman, *Ill. Eng.*, Vol. XX, 1927, p. 252.
Jones (Miss), *Ill. Eng.*, Vol. XX, 1927, p. 252.
Hawkins, *Ill. Eng.*, Vol. XX, 1927, p. 252.

Spectral Characteristics of Light Sources and Window Materials Used in Therapy

IN view of the extraordinary growth of interest in the alleged beneficial effects of ultra-violet rays, and the widespread experiments being made with various sources rich in such rays as an aid to medical treatment, special interest attaches to a recent paper by Dr. W. Coblentz*, in which the radiation from the chief sources of this kind and the transmission characteristics of various kinds of window glass are surveyed.

Dr. Coblentz commences by defining the various regions of the spectrum, known as infra-red, visible, and ultra-violet—a point on which some confusion in the minds of inventors is sometimes evident. The far ultra-violet rays (180–290mμ) are almost completely absent from the sun's rays at ordinary altitudes. Such rays cannot penetrate deeply into the skin—a layer of epidermis 0.03 mm. in thickness was found to be practically opaque to ultra-violet rays of wavelength less than 300mμ—but they have a very strong surface effect and a powerful germicidal effect. Even the near ultra-violet (290 to 365mμ), which are frequently regarded as the "health-giving rays," form only a small fraction of the total radiation energy radiated by the sun. At sea-level, during the noon hours, only 3 per cent. of the solar radiation lies between 290 and 315mμ, though this region is very much more effective at high altitudes, say over 7,000 feet. Even these rays cannot penetrate the skin to a depth greater than perhaps 0.5 mm. The therapeutic value of the visible rays (390 to 760mμ) is largely undetermined, but the penetration into the blood stream cannot be very deep (0.5 to 1 mm.), though in certain parts of the body they may penetrate 3 to 5 mm., and perhaps even deeper. Infra-red rays between 760 and 1,500mμ are probably the only ones that can penetrate deeply into the blood stream. The earth's atmosphere transmits practically no solar radiation of wavelengths greater than 4,000mμ. The glass bulbs of enclosing incandescent filaments are opaque to wavelengths greater than the above limit.

In the next section of his paper Dr. Coblentz analyses the radiation of the sun, the carbon arc, various cored and impregnated carbons, the gasfilled tungsten lamp, arcs between tungsten and nickel electrodes, the quartz-tube mercury arc, and finally various types of radiant heaters. The spectra yielded by such sources are widely different, and the anomaly of grouping all such sources together under the generic title of "artificial sunlight" is evident. The ultra-violet radiation emitted from a 1,500-watt tungsten lamp was found to be minute, and a bulb of clear glass absorbs practically all infra-red radiation of wavelength greater than 3,000mμ.

The section analysing the qualities of various forms of window glass designed to transmit ultra-violet rays is also of great interest. One practical point may be noted. Under ordinary circumstances only the hands and faces of people are exposed. If, therefore, they are in need of ultra-violet stimulation, it is suggested that they would do better to undergo light-baths under medical advice rather than to anticipate great benefits from casual exposure to ultra-violet light filtering through window glass. On the other hand, in the case of hospitals and sanatoria, where patients may lie unclothed exposed to sunlight filtered through special glass windows, there is much more to be said for the use of window glass specially permeable to ultra-violet. The author's remarks on artificial silk are also interesting. Thin films of this material are doubtless highly permeable to ultra-violet. But this degree of transparency may not extend to the material woven into cloth, and the transmission as a whole depends mainly on the interstices in the material.

It may also be noted that most dyes absorb the ultra-violet rays, and that therefore important therapeutic effects can hardly be anticipated from the wearing of woven garments which are also coloured.

**Trans.* Illuminating Engineering Society, March, 1928, pp. 247–300.

POPULAR & TRADE SECTION

COMPRISING

Installation Topics—Hygiene and Safety—Data for Contractors—Hints to Consumers

(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society; and is based on outside contributions.)

Light and Visibility

By W. J. JONES, M.Sc.
(E.L.M.A. Lighting Service Bureau.)

PART II

(Continued from p. 176, June, 1928.)

BRIGHTNESS.—Brightness contrast comprises one of the most important factors in visibility. It is somewhat unfortunate that the technical term defining brightness is not directly connected with illumination.

The technical terms employed in illumination have developed from the earliest lighting unit, "the candle," and it is perhaps natural that all other units should be referred back to this. Unfortunately, however, brightness measured in terms of candles per square inch, while having some meaning when designating the brightness of a length of filament, is difficult to conceive when considering the brightness of a reflecting surface such as a wall, book, or a piece of work in the machine shop, because the brightness is essentially brought about by illumination and the power which the object has of reflecting light. It seems, therefore, desirable that on the score of simplicity brightness of a surface should also be expressed in terms of the light received combined with its reflectivity when dealing with illumination problems. Some such term as "reflected foot-candles" or "reflected lumens" would appear to be appropriate.

Field Brightness.—The amount of light available materially modifies the ability to see, since it affects field brightness, and thus the condition of adaptation of the eye. Various experimenters have shown the relationship between the acuity of the eye (ability to perceive fine detail) and the amount of light available. It appears that visual acuity, for a given set of conditions, varies approximately according to the logarithm of the illumination. Why, for a given contrast, the eye can see better under high intensities than under low intensities of illumination we do not know exactly; it has been suggested that under a higher intensity of illumination the pupil of the eye, while reducing the amount of light that enters, also reduces the amount of distortion or aberration inevitably associated with the lens of the eye.

The tests carried out by Messrs. Hartridge and Lythgoe,* using capital letters of the alphabet, are of interest. The letters were presented one at a time in irregular order, and the observers asked to recognize the letter presented. It was found that as the intensity of illumination was increased the number of mistakes in recognizing the letters decreased; consequently, when the results of the tests were plotted in terms of acuity against intensity of illumination, it was found that an increase in illumination resulted in increased acuity. Their conclusions are of great importance in the lighting world:—

* "Influence of Illumination on Visual Acuity, Optical Convention, 1926."

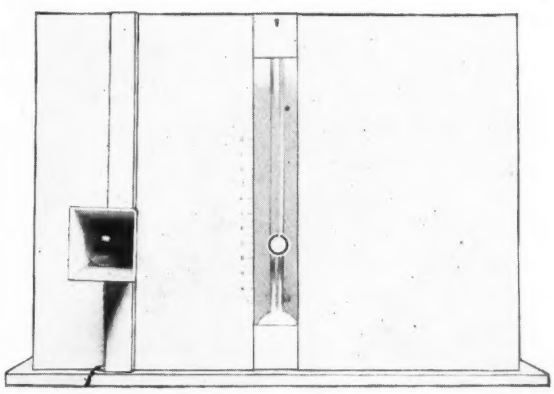


FIG. 1.—Apparatus for testing speed of vision under different light intensities.

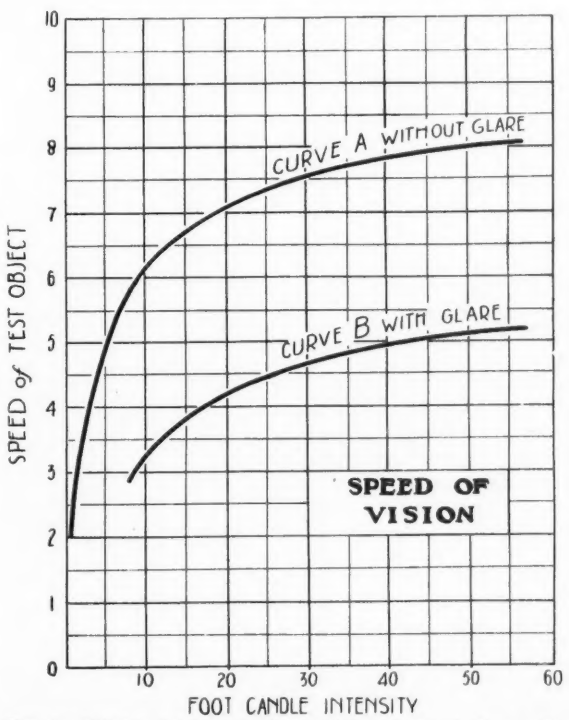


FIG. 2.—Relation between speed of vision and illumination, with and without glaring source.

"While artificial illumination of 2 to 4 foot-candles is most probably adequate for a variety of purposes, our results, which agree closely with those of König, *indicate that only about one-half the full acuity of the eye is achieved at this intensity. For the maximum acuity an intensity of* 100-200 *foot-candles is necessary.*"

The Time Element.—Unfortunately, acuity tests only serve to investigate one function of the eye, since in practice the eye is called upon to focus with facility first on one object and then on another, the change being made very quickly, so that a time element must be taken into consideration. Such tests, however, as those on the speed of reading have yielded similar results to those on acuity. As the illumination is increased the eye is able to perform its task more readily. For instance, in one reading test an increase of illumination from 4 to 8 foot-candles brought about an increase in the speed of reading of some 24 per cent., and (within limits) every time the illumination was doubled it was found that a further increase of 24 per cent. was obtained.

Similarly the eye can see an object that is moving far more readily when a high intensity of light is available than it can in a poor light.

The experimental apparatus described in the following readily demonstrates this, the apparatus being shown in Fig. 1. A heavily weighted pendulum carries a light, movable, test object, which can be adjusted up and down the shaft of the pendulum. Since the periodic time for the pendulum is constant, it follows that the time the object is in view will be approximately inversely proportional to its distance from the pivot, and the linear speed of the object approximately proportional to the distance from the pivot. But tests have shown that in this experiment the speed is the major factor in visibility. since the time interval is always well above the minimum for perception. In any event the effect of the time interval in the experiment is of the second order of magnitude. A white paper disc with a black discontinuous circle forms the test object. If a certain amount of illumination is provided and the pendulum set swinging, the position of the test object can be adjusted up or down the pendulum until the gap in the discontinuous circle can just be seen as it passes across the opening of the apparatus. It is found that with high intensities of illumination an observer can recognize the position of the gap in the test object when it is placed near the bottom of the pendulum, i.e., when moving very fast, while when a poor illumination is provided the test object must be placed much nearer the pivot. A curve, therefore, potted with "distance from the pivot" as ordinate, and "illumination intensity" as abscissæ, is proportional to a curve of "speed of vision" and "illumination." Such a curve obtained with this apparatus is shown in Fig. 2 (Curve A).

The Effect of Glare.—It has long been known that glare interferes with vision, but apart from the discomfort and fatigue which it brings about it is not usually realized to what a remarkable extent glare is responsible for a reduction in visual efficiency. On the apparatus described above a source of glare can be introduced, and when the tests are repeated under these conditions the Curve B shown in Fig. 2 is obtained. This is of great interest, because it shows that at all values of illumination there is a reduction in "eye efficiency" when glare is present,—the speed of recognition at a given illumination is reduced greatly. Let us look at this matter in another way. To obtain the same speed of seeing with glare as obtained without glare, the illumination must be increased a tremendous amount. Consider a concrete instance. Under 5 foot-candles without glare the eye can perceive the test object at a speed corresponding to 5 on the diagram (Curve A). In order to obtain this same speed in the presence of glare (Curve B) the illumination has to be increased to 40 foot-candles!

(*To be continued.*)

Illuminations during the "Greater Brighton" Week

The accompanying illustrations give a good idea of the special lighting initiated during the recent "Greater Brighton" week. It was fitting that advantage should be taken of this opportunity to show what lighting can do. The floodlighting in colour of the Royal Pavilion was a striking display, and the festoons of coloured lamps distributed along the front may be clearly seen in the second illustration.

FIG. 1.—Royal Pavilion, floodlighted by 30 G.E.C. Projectors.

Special interest attaches to the new Wembley lanterns on the parade, which are seen in Fig. 3. It will be recalled that the introduction of these new decorative

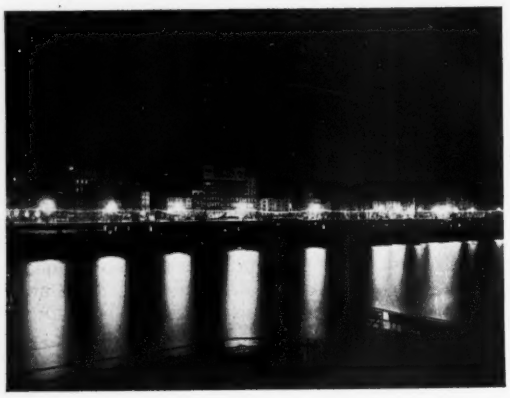


FIG. 2.—A 3 a.m. view of illuminations on Brighton Front, taken from West Pier. Note Metropole and Grand Hotels in background.

lanterns was mentioned by Mr. Christie in his address at the conference of the Association of Public Lighting Engineers held in Brighton last year.

FIG. 3.—Brighton Front, illuminated by G.E.C. Twin Wembley Ornamental Units, each equipped with two 1,500-watt Osram Lamps.

The Technique of Show-Window Lighting

SOME time ago we referred to the admirable booklet on the above subject prepared by Dr. F. Putnoky, of the Osram G.m.b.H., in Berlin. The second volume (Osram Lichtheft B.11) is now to hand. It may be recalled that the first volume was devoted to shop windows which might be considered normal in regard to dimensions and design. This second booklet deals with exceptional cases, which, again, fall into several divisions. In the first section of the book illustrations are given of windows so arranged that the contents of the shop behind are out of sight. Even such windows present special lighting problems arising from their design. Dr. Putnoky discusses such questions as the treatment of very deep or shallow windows, or cases in which part of the space is obscured by an opaque screen.

In Fig. 1 we reproduce an interesting illustration in this section, the illumination of a large corner store. One of the chief difficulties in lighting such displays is the fact that lamps used in fittings in one window are liable to be visible to the eyes of observers looking in through another. In this case one method of eliminating this trouble—the use of screens between lamps and perpendicular to the surface of the window—is shown.

The second section deals with windows so arranged that the contents of the inner shop are visible. These again present difficulties, arising chiefly from the interference of the background, which may consist of transparent media, some of which occasion troublesome reflections of light sources. These problems are illustrated by many excellent photographs. We have also to consider such installations as automobile showrooms, where the whole interior is occupied by the goods and is visible, and the window display and the contents of the shop are one.

In Fig. 2 we have an illustration of yet another type of window, in which a false ceiling is used and lamps are mounted in slots at intervals. Such installations may be quite effective, but the method must be pursued with discretion in order to avoid lack of uniformity and unsightly shadows.

These are only two out of many excellent illustrations. Attention may be drawn to the systematic way in which each problem is treated, a photograph of an actual installation being presented on the right, whilst the left-hand page contains diagrams and explanatory data.

A third booklet by Dr. Putnoky (reproduced from "Kristall-Spiegelglas") is devoted exclusively to the question of reflections of external objects in the glass of shop windows. Reflections of such bright objects are familiar and troublesome phenomena. Attempts have recently been made to overcome this difficulty by adopting super-illuminations such as to render the reflections inconspicuous, but a very high illumination is necessary. In Fig. 3 we have a typical case of very troublesome reflection. In this case the image of objects in the street outside is sufficiently marked to spoil the appearance of the window completely when the window is unilluminated. This photograph was taken at 4-30 p.m. on January 1st. In Fig. 4 we have a photograph of the same window taken at 5-30 p.m. on the same day and artificially illuminated (5,000 watts being expended). The image is still visible, but it is very much less noticeable than before. The allowance of 5,000 watts for this window is regarded as beyond that which would suffice during complete darkness when daylight has vanished. It nevertheless still falls short of what would be necessary to eliminate the reflection completely. It is

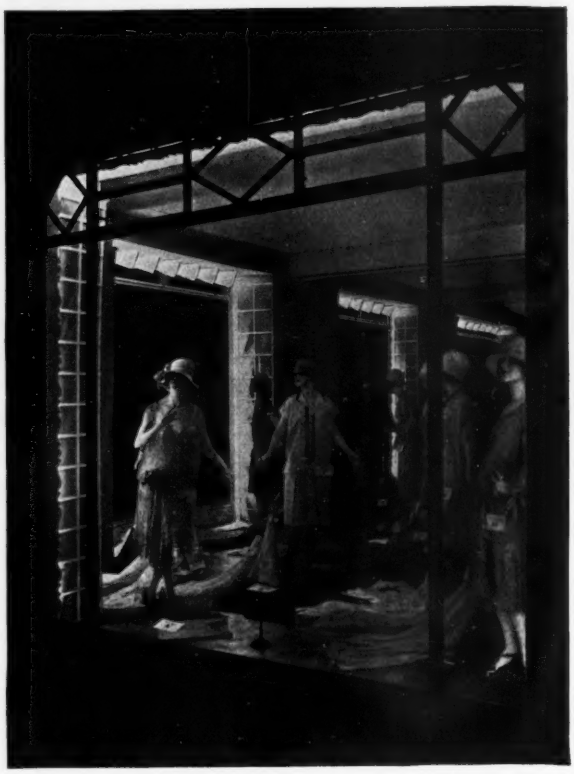


FIG. 1.—A good example of treatment of a corner window, illustrating the use of screens beside the light sources, so as to render the latter invisible to persons outside the window.

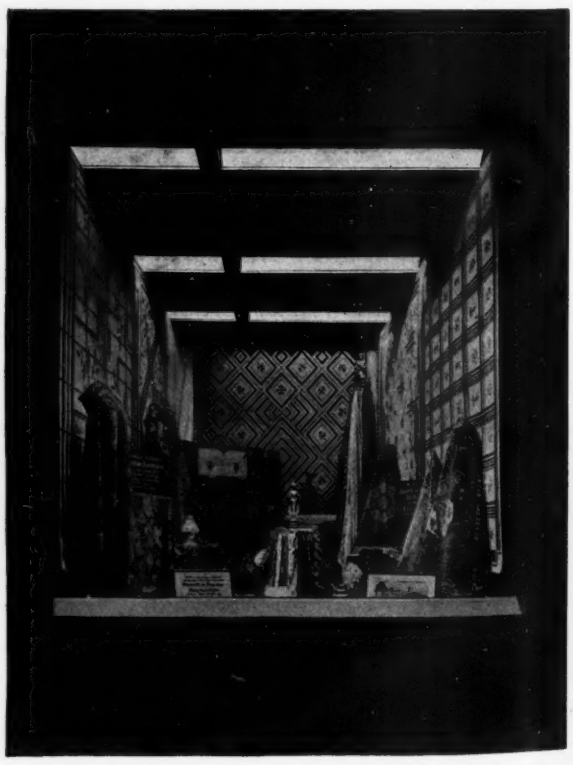


FIG. 2.—A window illuminated by light emitted from slots in a false ceiling.

suggested that in such cases merchants might with advantage adopt an exceptionally high illumination during the period when daylight is beginning to fail, but has not yet vanished. This could be reduced (e.g., by adopting 2,000 watts instead of 5,000 watts for the window here illustrated) when complete darkness has set in.

We are indebted to Dr. Putnoky for the use of the illustrations accompanying this note, and we recommend this excellent series of booklets to the notice of illuminating engineers in this country.

FIG. 3.—Photograph taken at 4-30 p.m. on January 1st; window not illuminated by artificial light. Note the troublesome reflection in the window glass of objects in the street.

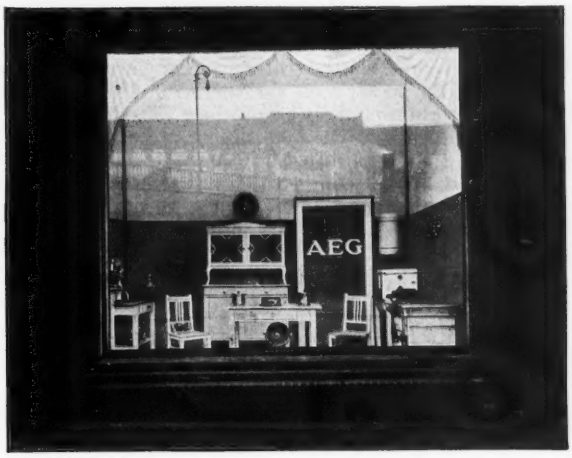


FIG. 4.—Photograph of the same window taken at 5-30 p.m. on the same day. The window is artificially lighted, 5,000 watts being thus expended. The reflected image is still visible, but is much less marked than in Fig. 3.

Shadow and Contrast Effects in Window Lighting

THE two sets of pictures below, for which we are indebted to the courtesy of Messrs. Korting & Mathiesen Electrical Ltd., show very clearly that completely diffused light is not usually desirable in shop-window lighting. In most cases the contents of a window need to be flooded with light, and the sources should, of course, be completely concealed from the eyes of observers, but the degree of diffusion of the light (effected either by using lamps with frosted bulbs or by enclosing the lamps in opal glassware, or by utilizing the reflected light from the surroundings) should vary according to the nature of the display. Merchants, moreover, often desire to emphasize certain objects in the window—hence the popularity of " spotlights " for special effects.

The pictures below, which appeared in the last issue of the *Kandem Quarterly Review*, illustrate somewhat extreme cases. Glossy material, such as that used for the lady's hat, is apt to appear dull and uninteresting if illuminated by completely diffused light. The same applies to glass crystalware and jewellery. In the latter case the light should come from sources of relatively small dimensions, so that the glittering effect of their reflection in the polished surfaces is secured. This fact may explain the tendency in some jewellers' shops for bare lamps to be scattered amidst the contents of the window. Bare lamps may actually be best in some such cases; but they should always be hidden from the eyes of the customer, otherwise their dazzling effect prevents him from appreciating the sparkle on the goods themselves.

FIG. 1.—Showing the appearances of a Lady's Hat.
Left: Direct light. Sharp shadows. *Right:* Diffused light. Soft shadows.

FIG. 2.—Showing appearances of Crystalware.
Left: Direct light. Bright " contrast " effect. *Right:* Diffused light. Soft and dull effect.

The Growing Services of the Gas Industry

THE following extracts from the Presidential Address of Mr. H. D. Madden, M.Inst.C.E., M.I.Mech.E., at the Annual Meeting of the Institution of Gas Engineers, at Cardiff, June 12th to 15th, have been selected as bearing on questions of interest to the general public and to illuminating engineers. Much has necessarily been omitted from an address which very properly was in the main devoted to the internal problems of the gas industry.

Gas as a Curative Agent.

A sub-committee of the Institution has produced during the year a most striking report entitled "Gas for Clinical Purposes," on the therapeutic uses of gas. This investigation is likely to produce valuable information with reference to the qualities of radiant heat from gas fires and its application for curative purposes. Sir Henry Gauvain is conducting researches at Alton, Hants, and high scientific attainment is represented on the sub-committee. It appears quite possible that great advances will be made by the use of certain new materials for the radiants of gas fires.

Magnitude of the Gas Industry.

To-day we stand in the position of being the chief and largest exponents of the art and practice of the carbonization of coal. As an industry, we carbonize some 17 million tons of coal per annum for gas production; and we carbonize this quantity in the most efficiently commercial manner yet known—obtaining thereby a thermal efficiency as high as 80 per cent. of the original coal, translating this for the uses of mankind, and supplying our gas service through approximately 9,000,000 meters to some 30,000,000 to 40,000,000 inhabitants of this kingdom.

If more efficient methods of manufacture can be found, then, as practical propositions, the gas industry will be in the vanguard to adopt them, and will not fear to scrap older and less efficient plant; for we claim that a true commercial instinct balances and governs the engineering decisions of our profession. Above this is realized the outstanding idea of service, in its truest meaning, to the public we have the honour to serve with the means of light, heat and power, together with many series of chemical products which can be obtained only by the constructive distillation of coal. I say "constructive" advisedly, since the phrase "destructive distillation," to my mind, can only be used to describe the alternative methods of burning raw coal in a grate (as an open fire) or under a boiler, or in such other methods whereby the lowest heating efficiency is obtained from the coal, while the valuable constituents are driven off and pushed up the chimney, with consequent pollution of the atmosphere, with its attendant evils of destructive effects on buildings, lessened sunshine, increased dirt, diseases of darkness, grime, and labour. Surely this method is destructive carbonization, while the gasworks and coke-oven works system is, in substance and fact, truly constructive in its method and application.

During the Great War the carbonizing industry of Great Britain supplied the bulk of the high explosives, and other articles of warfare, for the Allied armies. It is always well to keep this utility of our industry for potential defence before our countrymen.

During the coal stoppage of 1926, for seven months our undertakings supplied the homes of millions with light, heat and fuel; and the magnitude and full meaning of this has never been realized by the man in the street, or admitted by the politician, or by the Government itself.

The great new system of arterial roadways, as well as the earlier and older roads, can depend upon our industry for supplies of manufactured tar, etc., for road-making—while the agriculturist can look to us for fertilizers, and the dye and colour industries for the supplies of their raw materials. These are not all, for we supply the electricity industry with their solid carbon, which is vitally necessary in the construction of electrical plant.

In the next section of his address Mr. Madden referred to the remarkable change which has come over the gas industry during recent years.

Recent Growth.

During the period of a single lifetime a 90 per cent lighting load of the gas industry has been translated to a 90 per cent. heat and power load; and, marvellous to relate, concurrently the output of gas during that period has been more than quadrupled, while its extended use in new directions ensures continued progress.

Notwithstanding the alteration of the loads there is value in the retention of the lighting load. Modern fittings and burners provide the cheapest, cleanest and healthiest form of lighting for the dwelling-houses of the ordinary consumer. Light, warmth and ventilation are provided by incandescent gas lighting at an average burner cost of one penny for five hours.

Disregarding the use of electricity for tramways, and confining the comparison to purely domestic service, it would appear that the quantity of electricity used is approximately 10 per cent., as against 90 per cent. use of gaseous fuel supply. In 1926 the gas output showed an increase of 54,056,470 therms over the previous year, against an increase of 7,165,801 therms for electricity; the ratio of gas increase to electricity increase being 7.54 to 1. To the most timid of believers and investors, truly these facts and figures must be a *sursum corda* to inspire confidence.

The question of coke supplies to the cities and townships has yet to be added to the above, if the true potential heat energy supplied by the gas undertakings is under review and examination.

General Interest in Carbonization.

Not only the public, but leading politicians, are turning their attention to the carbonization of coal in one way or another; and it is apparent that there has been a general awakening to the great future possibilities of the processes the gas industry adopts for the treatment of coal. The gas industry desires to develop sturdily, as for 100 years past, having entire freedom from political interference and Government restrictive control.

The interests of cultured and scientifically trained minds are focussed on the question of the future development and possiblities of carbonization, with the co-ordination and economical utilization of the whole of the fuel resources, including waste or surplus heat, in Great Britain.

Carbonization is a progressive science, and the yield of therms per ton of coal carbonized is increasing; while the reclamation of surplus heat is a problem that is receiving more general attention.

Rating Relief.

Mr. Madden made a brief reference to the promised rating relief to productive industries, as outlined by the Chancellor of the Exchequer in his Budget Speech. "If," he said, "the gas industry is debarred from participating in this it will be a grave injustice, not only to the gas industry itself, but to the many millions of gas consumers, such a large number of whom belong to the working class."

British Industries Fair, 1929

According to Mr. R. B. Hodgson, the Chairman of Council of the Society of British Gas Industries, it is intended to make the Gas Section at the British Industries Fair, 1929, "everything that can be desired and thoroughly worthy of the gas industry." It is expected that the section will be developed on broader lines next year, and we understand that the lighting section will probably be considerably extended.

The Ideal Home

How the Gas Industry Promotes It.

The daily average of hours of sunshine in Cornwall, as measured at Falmouth, is 4.4; whilst the daily average for the whole country is 3.66.

Mr. F. G. Kingwell, Hon. Secretary of the Cornish Association of Gas Managers and Secretary of the Falmouth Gas Company, who quoted these figures at a District Conference of the British Commercial Gas Association at Truro on May 24th, said that if the gas industry in Cornwall could not claim credit for the higher average, it could at least claim that the average for other parts of the country could be improved by the increased use of gaseous fuel.

50,000 Chimneys Stop Smoking.

Only recently, said Mr. Kingwell, the Chairman of a London undertaking (the Gas Light and Coke Company) had informed a meeting of architects and builders that 50,000 gas fires had been fixed in London alone during the past winter. When one thought of 50,000 chimneys ceasing to pour forth filthy smoke one realized the service gas was rendering to the community.

Healing Heat by Gas Fires.

Mr. Kingwell mentioned the research work of Dr. Harold Hartley, through whose efforts a gas fire would shortly be placed on the market giving heat of a definite therapeutic value—akin to the sun's rays. This fire would revolutionize heating as the gas cooker had revolutionized cooking. At present there were five million gas cookers in use in England and Wales, apart from those privately owned. The modern cooker, with all-enamelled surface and automatic heat-control for the oven—enabling food to be cooked without any attention whatever—was within the reach of all, since most undertakings were willing to supply it on the hire purchase system, and even deliver it " in a plain van."

" Der Tag "—Washing Day and Hot Water.

In most homes washing day used to be *the day*—Black Monday. But the gas wash boiler had revolutionized that day, and now thousands were being fixed up and down the country in preference to the old-fashioned coal-fired copper with its attendant discomfort. For workmen's dwellings this could also be used for the supply of hot water to the bath. The " ideal " home had to have an ample supply of hot water. It should be commonly known, said Mr. Kingwell, that there were many appliances heated by gas which gave an instantaneous supply, but in his view the most utilitarian was the multi-point geyser, which would supply hot water to any number of taps, working under the same pressure as the cold-water main supply, thus eliminating the kitchen boiler and its circulating pipes. The turning of any hot-water tap automatically raised the gas and hot water was immediately available. With the exception of the pilot light, this appliance consumed gas only when hot water was required.

Housing Schemes.

In all parts of Cornwall, went on Mr. Kingwell, the Delectable Duchy had realized its duty in the provision of artisans' dwellings. At Truro 200 houses had been erected, each with a gas supply for lighting, and in many cases for cooking and heating. At Falmouth a model village of 155 houses known as " Swanvale " had been erected for the employees of the Docks Company, and here every house was using gas for lighting, cooking, and in many cases for hot-water supply. Falmouth Corporation had also erected 300 houses which were practically all-gas, and the same authority was now embarking upon a fourth scheme of 150 houses.

At Camborne 82 all-gas houses had been fitted, after keep competition with the Electric Company, whilst at St. Austell 170 new houses had been fitted with gas appliances for all purposes. This was typical of the way things were going all over the country. Age was adding strength and importance to the industry whose pioneer, William Murdoch, had carried out his first experiments in the neighbouring town of Redruth.

Progress on Merits.

The gas industry, said Mr. Kingwell, was very much alive. It could and would progress, without subsidy, on the merits of its service. The year 1927 had shown an increase over 1926 of over 230,000 gas consumers, and these additional consumers had been acquired because they wished to have ideal homes and because the gas industry had shown its desire to serve the community.

A New Use for Bunsen's Great Invention.

The press during the last few weeks has been unanimous in its praise of a new appliance which is utilizing the heat of gas to make coldness. The great invention of Bunsen, which is now adopted for lighting our homes and streets, cooking our food, and keeping us warm, is now being brought into service for making the coldness required for refrigeration. *The Times*, in its recent report on the subject, states that " the new machine is in four sizes for domestic use, according to the size of the flat or house in which it is used. No ice is needed. The refrigerating unit consists of three small cylindrical vessels connected by pipes and charged with distilled water, ammonia and hydrogen. The pipes and the cylinders are welded together so that the escape of the liquid or gaseous contents is impossible. A very small gas burner beneath one of the cylinders is lighted up, and refrigeration commences and is continuously maintained without further attention. All the trouble of securing an ice supply and constantly cleaning out an ice cabinet is done away with, and the cost of operating is from 1½d. to 3½d. a day. The domestic gas-operated refrigerator preserves both cooked and uncooked meat, game and fish; it keeps milk fresh, and butter in proper condition; it sets jellies quickly, cools lemonade and wines, and provides crystal-clear blocks of ice for table use, and simplifies the provision of home-made ice-cream. It is available in large sizes for use on a commercial scale."

Truly the gas industry is to be congratulated on finding its " thousand-and-second " use for gas, and our indebtedness to Bunsen is further increased.

The First German Gas Works

A recent issue of *Licht und Lampe* reproduces an old print showing the original installation of a gasworks in Dresden, in 1828. This is regarded as the pioneer gasworks in Germany. The project seems to have been initiated by an Englishman, General Congreve, but the actual erection of the installation was undertaken by Rudolf Blochmann, who for some time previously had been associated with Reichenbach and Frauenhofer, and who, after the termination of the Napoleonic wars, established an engineering works in Dresden.

The work was completed early in 1828, and on April 28th, the birthday of the eldest son of King Albert of Saxony, the vicinity of the imperial castle and the Catholic church was lighted by gas for the first time. This was the first application of gas for street lighting. In subsequent years the whole town of Dresden was gradually lighted by this means. Other towns soon followed. Blochmann, in succession, introduced gasworks into Leipzig, Gotha, Breslau and Berlin; later, in the latter town, his son became the first director of a municipally owned gasworks.

It is of interest to note that the same year, 1828, which saw the origination of the gasworks in Dresden likewise saw the beginning of the technical institution which to-day has become the Dresden Technische Hochshule.

Illumination at the International Press Exhibition in Cologne

Readers may recall the account contributed to this journal by Dr. Halbertsma of the special lighting at the " Gesolei " Exhibition held in Dresden last year.

The idea of embodying illumination as an essential element in important exhibitions is evidently gaining ground abroad. Another instance is afforded by the International Press Exhibition recently held in Cologne. The opportunity was taken to illuminate not only the exhibition itself but other prominent buildings in the city. Judging from the illustrations which accompany a description by Dr. Gerhard Schmidt, which appears in *Licht und Lampe*, the opportunity of interesting the public in the possibilities of artificial light seems to have been used to advantage. Most of the illustrations show views taken from the other side of the river. Amongst the prominent buildings which were floodlighted may be mentioned the Town Hall and the spires of Cologne Cathedral, which stand out in the darkness. 185 kw. was allotted to the illumination of this famous cathedral.

The Hohenzollern Bridge was illuminated by festoons of 14-watt lamps spaced about 16 cm. apart, 1,500 such lamps being thus used. Many of the exhibition buildings, which covered a considerable stretch along the river, were also outlined in incandescent lamps (usually 15-watt lamps at intervals of 15 cm.). The lighting of the main " Pressa " building was effected mainly by a series of 40 500-watt lamps mounted in opal glass globes. Another feature was the " Pressa " tower, which carried a rotating unit consuming 10,000 watts.

Naturally the Rheinpark Restaurant also received special festive lighting, something like 3,000 15-watt lamps being here employed, and most of the special exhibits of individual newspapers seem to have made use of lighting devices for purposes of publicity. Another feature of the exhibition was the extensive use made of diffusing glassware, one of the main routes through the exhibition being illuminated by high masts equipped with globes 75 cm. and 40 cm. in diameter, and each containing three 75-watt lamps.

The adjacent amusement park was brilliantly lighted, neon tubes playing a prominent part at the entrance leading to a series of shops (though the author hints that the lighting of some of the windows might not be considered entirely happy). The Danish pavilion is singled out for special mention as an instance of ingenious lighting, one of the main features being the " staircase of lights " at the main entrance.

A Permanent White Line

One of the chief devices for the guidance of traffic introduced in this country during recent years, which has proved most effective, is the " white line " defining the course of traffic, especially at corners. This device has probably done more to diminish accidents than many much more elaborate devices.

The simplest plan, the stencilling of white lines on the dark wood paving, is quite effective, but it has two drawbacks. Its success assumes a background which is not only itself dark in texture but sufficiently smooth to enable the impress to be made; and it is easily obliterated by traffic, and thus requires constant renewal.

Various attempts have been made to devise more permanent marking. Amongst these the metal studs adopted in some London streets may be mentioned. These are permanent and fairly effective. But they become highly polished under the influence of traffic, and their distinctiveness therefore depends on the reflection of adjacent lamps in the polished surface—a condition that is not entirely satisfactory, as the reflection is apt to disappear and reappear as the vehicle moves, and is liable to be confused by reflections from adjacent portions of street which, although dark, also tend to become shiny.

An interesting new device is the " snow-white " permanent line recently laid down by the County Surveyor of Northamptonshire, which is illustrated in a recent issue of *Safety First*. The white line is executed in hard natural stone, which is stated to wear well and requires no maintenance. The white line is assisted by a border of dark material, and shows up well both by night and by day.

The most effective arrangement of all is doubtless the permanent white line consisting of inlaid slabs of translucent material, which can be illuminated at night by means of lamps concealed in a trough underneath. There can be no question of the superior visibility of such an arrangement at night, and the experimental installation at Hendon gave promising results. It is, however, naturally somewhat more expensive, and this is no doubt the chief reason why it has not yet been very widely used.

Sheffield Illumination Society

A most interesting and enjoyable time was spent by about forty members and friends of the Sheffield Illumination Society on the 24th May, when a visit was made to the Sheffield Automatic Telephone Exchange.

To view the various apparatus in connection with the working of the automatic system was very educative, and the guides who conducted the party over the Exchange explained in detail the many technicalities.

Mr J. R. Hall (President of the Society) thanked Mr. James and his assistants for the facilities which had been made for their interesting and instructive visit. In reply, Mr. James expressed the pleasure it had been to show the members of the Society the Exchange.

TRADE NOTES & ANNOUNCEMENTS

MODERN FACTORY LIGHTING.

In these days of keen competition it is the most efficiently equipped factories that prosper, and no part of the factory equipment has a more direct bearing on its efficiency than the lighting. The advantages of good lighting in reducing accidents and spoilage and improving production have frequently been emphasized. Each factory presents special problems, which must be considered on their merits. But the modern tendency is strongly towards the provision of general overhead lighting, which enables lighting units to be kept out of the direct range of vision and leaves a clear view of the room illuminated.

A typical modern illustration is shown in the accompanying illustration of the automatic machine shop of Messrs. British Timken Ltd., Birmingham. This room is lighted by 27 300-watt Cosmos gasfilled lamps in R.L.M. reflectors, mounted 11 feet above the floor and spaced on 16-foot × 12-foot centres. An illumination of 8 foot-candles is provided on the machines, and it will be observed that the lamps are effectually screened by the reflectors which flood the area evenly with light. In the viewing shop in the same factory an illumination of 12 foot-candles is provided, and the lamps are bowl-sprayed to eliminate glare arising from the reflection of the filaments in polished surfaces. Incidentally, it may be pointed out that a correctly planned lighting installation of this kind, besides being in the consumer's interest, also benefits the supply undertaking by furnishing a useful load. In this factory, exclusive of offices, 380 lighting points are provided, and the total connected load is 90 kw.

The installation was carried out by Messrs. Glover, Birmingham, to the specification of Messrs. Metro-Vick Supplies Ltd.

SPECIAL LIGHTING DURING THE "GREATER BRIGHTON" WEEK.

Readers will recall the interest taken in the lighting of Brighton during the conference of the Association of Public Lighting Engineers, held in that city last year. On that occasion a paper was read by Mr. J. Christie, the Corporation electrical engineer, describing the lighting arrangements, and it was intimated that special provision was being made for additional lighting on festive occasions. An excellent opportunity for such effects was furnished by the "Greater Brighton" Week, which opened on May 28th. On the occasion of the opening ceremony, which was performed by T.R.H. The Duke and Duchess of York, the Royal Pavilion was illuminated in colour by 30 G.E.C. floodlight projectors, and the Old Steyne Gardens were decorated with thousands of multi-coloured lamps, floodlighting being also applied to the war memorial and the fountains, St. Peter's Parish Church and the aquarium.

It was, however, on the front that the most imposing lighting effects were contrived. The front is now illuminated by ornamental standards carrying twin Wembley lanterns and bearing the Brighton coat of arms. This illumination was supplemented by nearly two miles of Fairyland strip, carrying upwards of 10,000 colour-sprayed lamps in yellow, green, orange and red, and the bathing pool and Valley Gardens were also floodlighted by novel methods.

Readers will find on page 204 some illustrations of the special lighting adopted during this "Greater Brighton" Week. Included amongst these is an excellent view of the promenade equipped with the new Wembley lanterns mentioned above.

We have here an example which will doubtless be followed in other cities. Special lighting effects are now becoming a recognized element in civic festivals, and many seaside towns are providing for extra illuminations during the holiday season.

FIG. 1.—The Automatic Machine Shop of Messrs. British Timken Ltd., Birmingham, where overhead lighting furnishing 8 foot-candles is provided.

NEW PHILIPS BRANCH AT LEEDS.

Owing to rapidly extending business in the Yorkshire area, Messrs. Philips Lamps Ltd. have been forced to seek larger premises at Leeds, which will enable them to hold larger stocks of all Philips products, thereby facilitating deliveries. The company's Leeds address is now Philips House, Park Lane, Park Square, Leeds. Telephone: Leeds 29001-2-3.

FURTHER INSTALLATIONS OF "DIA" FLAME ARC LAMPS IN GERMANY.

Reference was recently made in this journal to the striking installation of 30-amp. "Dia" long-burning flame arcs in the Koenigsplatz, in Leipzig. We understand from Messrs. Korting & Mathiesen Electrical Ltd. that this installation has now been surpassed by a similar installation in the Augustplatz—the main open square in the city of Leipzig, in front of the University and Opera House. Here the 30-amp. arcs are mounted in groups of two on similar high posts, and over 20 of these powerful arcs are used to illuminate the square.

Another noteworthy installation of these lamps is in connection with the famous Wertheim building, the largest store in Berlin. Here "Dia" lamps are installed at a distance of about 15 feet from the top of the building, flooding the frontage with light and rendering the building a prominent landmark at night time.

ERRATA.

We desire to correct two small slips which occurred in our last issue. On p. 183 the diagram (Fig. 2) showing the polar curve of the K. & M. "Mirrorlite" lantern was obviously inverted. In connection with the note on Philips Industrial Lighting Fittings (p. 182) we should like to make it clear that the matter appearing under Fig. 2 referred to the Philips "*N.D.*" fitting. A glance at the catalogue of Messrs. Philips Lamps Ltd. will show that the "A.K." and "N.D." fittings are quite distinct products.

CONTRACTS CLOSED.

The following contracts are announced:—

SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD.:

London and North-Eastern Railway; for 10 months' supply of vacuum and gasfilled train lighting lamps.

GENERAL ELECTRIC CO. LTD.:

Metropolitan Borough of Holborn; requirements of Osram lamps for 12 months ending March 31st, 1929.

General Post Office; for 60,000 No. 2 type 50-volt Robertson carbon filament telephone switchboard lamps.

REVIEWS OF BOOKS AND PUBLICATIONS RECEIVED

ILLUMINATING ENGINEERING. *Edited by F. E. Cady and H. B. Dates.* (*Chapman & Hall Ltd., London,* 1928; *pp.* 513.)

It will be recalled that this work originated in a series of lectures first delivered at the Case School of Applied Science in 1918, and the contributors include Mr. M. Luckiesh, Dr. P. W. Cobband, and others well known in the illuminating engineering world. Even in the first edition, however, much additional matter was incorporated. The second edition, now before us, has been again revised, and the chapter on Fundamental Principles of Illumination has been largely rewritten. The book now contains 14 chapters, and extends to over 500 pages, and it has certainly become one of the most complete publications available for students. The first five chapters are devoted to fundamental principles, sources of light, photometry and physiological optics. Other chapters deal with colour, shadows and daylight, and the final seven chapters are devoted to applications (e.g., domestic and commercial lights, illuminated signs, and the lighting of streets, public buildings, factories, etc.). The final chapter, on light production, covers a wide range and discusses motor headlights, searchlights, lighthouses and military signalling. The book is fully illustrated, and there is an adequate index. References to other sources of information are given at the terminations of chapters, and we are inclined to think that in some cases these lists might be extended with advantage.

THE STORY OF ELECTRICITY, *by Herman Goodman, B.S., M.D., with an Introduction by Victor Robinson, M.D.* (*"Medical Life Press," New York,* 1928; *pp.* 62).

This little work contains brief biographical sketches of a number of the leading discoverers in the electrical field, but the author also describes his book as "a chronology of electricity and electrotherapeutics," and is specially concerned with the influence of light on health. In the early part of the work the researches of Newton, Young, Gilbert, Volta and others are described. A high place is assigned to Benjamin Franklin, whose experiments deserve recognition. The record is brought up to date by reference to the work of Einstein, Coolidge, Bohr, and other investigators of quite recent times, and is illustrated by numerous portraits of discoverers of the past.

STAGE LIGHTING, *by Harold Ridge.*

We understand that the above work is to be published by Messrs. W. Heffer & Sons Ltd., very shortly. It is stated that the author presents a general view of the subject, avoiding unnecessary technicalities, and illustrates his remarks by descriptions of some of the latest installations. There are not many books available on stage lighting, so that Mr. Ridge's work will be awaited with interest.

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